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# EFFECT ON SOYBEAN GROWTH OF SOWING TIME AND FERTILIZERS

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# ВЛИЯНИЕ НА РОСТ СОИ СРОКОВ ПОСЕВА И УДОБРЕНИЯ ПОЧВЫ

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*Abstract.* Soybean also increases soil fertility by absorbing atmospheric nitrogen through its roots. *The purpose in conducting research* is to increase the fertility of irrigated gray-brown (chestnut) soils in the Ganja–Kazakh region. It consists of determining the optimal sowing time, sowing scheme, and fertilizer norms that ensure water absorption for ensuring high quality. Field experiments were conducted in 2013–2015 on the basis of the central experimental base of the Azerbaijan Scientific-Research Cotton Institute on irrigated gray-brown (chestnut) soils. Field experiments were carried out in 3 single rows with soybean variety Umanskaya 1, sowing was carried out on April 1–5, April 10–15, and April 20–25. With a total area of 54.0 $m^2$ (30×1.80 m) for each variant, 20, 30, and 60 kg of germinating seeds per hectare were sown in 3 sowing schemes of 45×5 cm, 45×10 cm, and 45×15 cm. Phenological observations were made on 25 plants, and agrotechnical measures were carried out in accordance with the rules adopted for the region. Thus, nutrient content, sowing time, and manure fertilizer norms have a significant effect on soybean height. When the optimal sowing period of soybeans was carried out on April 10–15, in all three sowing schemes, the plant height increased compared to early and late sowing (April 1–5 and 20–25) in all variants. The best results were obtained in the variant of manure 10 t/ha + $N_{60}P_{90}K_{60}$, the reduced and increased norms of mineral fertilizers did not affect the soybean length much.

*Аннотация.* Соя увеличивает плодородие почвы, поглощая атмосферный азот своими корнями. *Цель проведения исследований* — повышение плодородия орошаемых серо-бурых (каштановых) почв Гянджа-Казахского района. Основные задачи — это определение оптимального времени посева, схемы посева и норм удобрений. Полевые опыты проводились в 2013–2015 годах на базе центральной опытной базы Азербайджанского научно-исследовательского института хлопка на орошаемых серо-бурых (каштановых) почвах. Полевые опыты проводили в 3-х однорядных рядах с сортом сои Уманская 1, посев проводили 1–5 апреля, 10–15 апреля и 20–25 апреля. При общей площади 54,0 $м^2$ (30×1,80 м) для каждого варианта было посеяно 20, 30 и 60 кг проросших семян на гектар по 3 схемам посева 45×5 см, 45×10 см и 45×15 см. Фенологические наблюдения проводились на 25 растениях, агротехнические мероприятия проводились в соответствии с правилами, принятыми для области. Таким образом, содержание питательных веществ, время посева и нормы удобрений навоза оказывают значительное влияние на высоту сои. При проведении оптимального срока посева сои 10–15 апреля во всех трех схемах посева высота растений увеличивалась по сравнению с ранним и поздним посевом (1–5 и 20–25 апреля) во всех вариантах. Наилучшие результаты получены в варианте навоза 10 т/га + $N_{60}P_{90}K_{60}$, пониженная и повышенная нормы минеральных удобрений не сильно повлияли на длину сои.

Т. 7. №5. 2021
https://doi.org/10.33619/2414-2948/66

*Keywords:* sowing, soybean, growth, gray-brown soil, planting dates, fertilizers.

*Ключевые слова:* посев, соя, рост, серо-коричневая почва, сроки посева, удобрения.

Soybean has been cultivated since ancient times and is considered to be a high-protein oily plant in the world. It is widely used in medicine, as food, technical, feed. There is no other plant in the world that is equal to it due to its rich composition of nutrients and its multi-purpose use. Therefore, this plant is cultivated on all continents of the planet. Production is growing every year. After wheat, rice and corn, soybean is in the 4th place. Soybean also increases soil fertility by absorbing atmospheric nitrogen through its roots. Soybean is a very profitable, economically, ecologically and agronomical very useful plant [3].

Soybean cultivation is also of great agro-technical importance. Like other legumes, the tuber bacteria that live at the root of this plant have the ability to assimilate atmospheric nitrogen. Soybean absorbs 70% of its nitrogen needs from the atmosphere. By improving the nitrogen balance of soybean in the next crop, it is possible to save 30-40% on nitrogen fertilizers, so it is considered the best predecessor crop, especially in cereals [2, 4].

The productivity of soybean depends on many factors, such as optimization of nutrition, stimulation of growth and development, use of plant nutrients from fertilizers and soil, and increasing the plant's resistance to environmental factors [7].

It has been found that in moderately cultivated soils, it is possible to get a higher yield from soybeans when the nutrient area per plant is 295 $cm^2$ [8].

When studying the effect of soybean sowing time on grain yield in the Amur region of Russia, it was determined that the highest grain yield was 2.90 t / ha when sowing soybean variety Lydia on 19.05-20.05 [6].

During the study of the effect of new height regulators on soybeans, it was determined that the plant height increased by 4-9 cm compared to the control, the number of beans increased by 5-12, and the number of grains increased by 12-26 (from one plant). Protein yield per hectare is 116-170 kg, fat yield is 58-102 kg/ha, which is higher than the control [5].

Organic fertilizers have had an impact on both productivity and quality of soybean plant grown on irrigated gray-meadow soils in Shirvan. In the given variants of Shirvan-2 compost, the height increased up to 100 cm, it means that 28 cm compared to the control variant. Productivity was 30.8 quintals or 10.6 quintals more than control. The weight of 1000 grains increased from 123 grams in the control variant to 150 grams in the given variant. Among the quality indicators, 37% protein and 25% fat were in the seed, and 22% protein and 18% fat in the non-fertilized version [1].

## *Object and methodology of the research*

Taking into account the importance of soybean plant in our country, our main goal in conducting research is to increase the fertility of irrigated gray-brown (chestnut) soils in the Ganja-Gazakh region. It consists of determining the optimal sowing time, sowing scheme and fertilizer norms that ensure water absorption for ensure high quality. Field experiments were conducted in 2013-2015 on the basis of the central experimental base of the Azerbaijan Scientific-Research Cotton Institute on irrigated gray-brown (chestnut) soils. Field experiments were carried out in 3 single rows with soybean variety Umanskaya 1, sowing was carried out on April 1-5, April 10-15 and April 20-25. With a total area of 54.0 $m^2$ (30x1.80 m) for each variant, 20, 30 and 60 kg of germinating seeds per hectare were sown in 3 sowing schemes of 45x5 cm, 45x10 cm and 45x15 cm. 100% of manure, 70% of phosphorus and potassium are plowed in autumn, the remaining 30%

Т. 7. №5. 2021
https://doi.org/10.33619/2414-2948/66

of phosphorus and potassium are fed, alternate between branches at the branching stage, and nitrogen is applied once. Phenological observations were made on 25 plants, and agro-technical measures were carried out in accordance with the rules adopted for the region.

The amount of common and assimilated forms of nutrients was determined in mixed soil samples taken from 0-30 30-60 and 60-100 cm layers to study the agrochemical properties of the soils of the experimental area.

In the soil samples taken: in pH potentiometer, total humus according to I.V. Tyurin, absorbed ammonia D.P. Konev, nitrate nitrogen Grandval-Lyaju, total nitrogen, total phosphorus K.E. Ginzburg and G. M. Sheglov, motor phosphorus by B. P. Machigin method,the total potassium was determined by Smith's method , and the exchange potassium was determined by P. B. Protasov's method in a flaming photometer.

Analysis of soil samples shows that gray-brown (chestnut) soils are not highly supplied with the assimilated forms of nitrogen, phosphorus and potassium. As can be seen from the table, the pH in the aqueous solution was 7.8 in the 0-30 cm layer, and 8.4 in the 60-100 cm layer in the lower layers. Total humus, nitrogen, phosphorus and potassium in a layer of 0-30 cm, respectively 2.15; 0.15; 0.13; is 2.39%. However, it gradually decreases to the lower in the 60-100 cm layers and respectively 0.85; 0.06; 0.07; is 1.51%. Absorbed ammonia nitrogen 18.0-6.5; nitrate nitrogen 9.7-2.6, motor phosphorus 15,8-4,5; exchangeable potassium fluctuates between 263.5-105.3 mg/kg.

The effect of sowing time and fertilizers on soybean height, depending on the food field, was studied in 2013-2014 at the stage of 4-5 true leaves, budding-flowering and full ripening. Soybean sowing was carried out during 3 sowings on April 1-5, 10-15 and 20-25, in 45x5, 45x10 and 45x15 cm sowing schemes and with different norms of mineral fertilizers on manure. The results of the study are given in the Table.

Table.

EFFECT ON SOYBEAN HEIGHT OF SOWING TIME
AND FERTILIZER NORMS OF THE FEEDING AREA

| *Sowing time* | *Fertilizer norms* | *4-5 true leaf* | | | *Bud-flowering* | | | *Full ripened* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *45x5 sm* | *45x10 sm* | *45x15 sm* | *45x5 sm* | *45x10 sm* | *45x15 sm* | *45x5 sm* | *45x10 sm* | *45x15 sm* |
| | | | | | *2018* | | | | | |
| *1-5 April* | Control (without fertilizer) | 15,5 | 17,8 | 18,5 | 45,2 | 48,6 | 50,3 | 71,3 | 75,6 | 80,3 |
| | Manure 10 t/ha (ground) | 16,8 | 18,5 | 19,8 | 48,3 | 52,8 | 54,6 | 74,8 | 81,8 | 85,6 |
| | Ground+$N_{30}P_{60}K_{30}$ | 18,3 | 20,5 | 21,5 | 53,5 | 58,5 | 60,5 | 81,3 | 88,5 | 93,1 |
| | Ground +$N_{60}P_{90}K_{60}$ | 20,5 | 22,8 | 24,3 | 58,6 | 65,5 | 68,6 | 88,6 | 95,2 | 101,5 |
| | Ground +$N_{90}P_{120}K_{90}$ | 19,3 | 21,2 | 22,6 | 55,6 | 62,6 | 69,5 | 85,5 | 93,2 | 98,2 |
| *10-15 April* | Control (without fertilizer) | 16,8 | 20,5 | 21,8 | 47,7 | 52,6 | 55,4 | 75,5 | 79,6 | 82,1 |
| | Manure 10 t/ha (ground) | 17,5 | 21,7 | 23,2 | 50,5 | 56,3 | 60,3 | 79,8 | 85,3 | 87,6 |
| | Ground +$N_{30}P_{60}K_{30}$ | 19,8 | 23,6 | 25,4 | 56,6 | 60,6 | 64,2 | 85,6 | 93,6 | 98,3 |
| | Ground +$N_{60}P_{90}K_{60}$ | 22,6 | 25,5 | 27,7 | 67,3 | 70,3 | 73,3 | 92,8 | 103,0 | 108,2 |
| | Ground +$N_{90}P_{120}K_{90}$ | 21,3 | 24,2 | 26,3 | 65,3 | 67,6 | 70,5 | 89,2 | 98,2 | 105,3 |
| *20-25 April* | Control (without fertilizer) | 13,4 | 15,2 | 18,0 | 43,1 | 45,8 | 47,2 | 67,2 | 71,2 | 75,2 |
| | Manure 10 t/ha (ground) | 14,8 | 17,2 | 19,2 | 45,2 | 48,3 | 50,5 | 70,3 | 74,6 | 80,5 |
| | Ground +$N_{30}P_{60}K_{30}$ | 16,5 | 20,1 | 20,8 | 48,2 | 53,5 | 55,2 | 75,6 | 79,5 | 85,2 |

T. 7. №5. 2021
https://doi.org/10.33619/2414-2948/66

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ground +$N_{60}P_{90}K_{60}$ | 18,2 | 22,3 | 23,7 | 53,2 | 61,2 | 64,2 | 80,2 | 86,2 | 93,4 |
| | Ground +$N_{90}P_{120}K_{90}$ | 17,4 | 21,0 | 22,5 | 50,2 | 58,3 | 60,3 | 78,6 | 83,5 | 90,1 |
| | | | | *2019* | | | | | | |
| *1-5 april* | Control (without fertilizer) | 16,5 | 18,6 | 19,7 | 46,8 | 50,5 | 52,3 | 72,5 | 78,3 | 82,5 |
| | Manure 10 t/ha (ground) | 18,3 | 20,7 | 21,5 | 50,2 | 54,2 | 56,2 | 75,6 | 83,6 | 87,8 |
| | Ground +$N_{30}P_{60}K_{30}$ | 20,5 | 22,1 | 23,8 | 55,6 | 60,3 | 62,3 | 83,5 | 91,7 | 97,5 |
| | Ground +$N_{60}P_{90}K_{60}$ | 22,3 | 24,3 | 26,1 | 60,7 | 68,3 | 70,5 | 90,6 | 99,3 | 105,8 |
| | Ground +$N_{90}P_{120}K_{90}$ | 21,2 | 23,3 | 24,8 | 57,3 | 64,2 | 67,6 | 86,8 | 94,2 | 100,1 |
| *10-15 Aprel* | Control (without fertilizer) | 17,5 | 22,8 | 23,7 | 50,3 | 55,3 | 58,6 | 79,6 | 83,3 | 85,6 |
| | Manure 10 t/ha (ground) | 18,8 | 23,5 | 25,1 | 53,5 | 58,6 | 60,2 | 81,5 | 89,6 | 90,7 |
| | Ground +$N_{30}P_{60}K_{30}$ | 20,7 | 26,7 | 28,2 | 58,7 | 63,5 | 66,3 | 87,5 | 96,7 | 101,5 |
| | Ground +$N_{60}P_{90}K_{60}$ | 23,5 | 28,3 | 30,1 | 70,5 | 78,3 | 81,3 | 98,3 | 108,6 | 115,7 |
| | Ground +$N_{90}P_{120}K_{90}$ | 21,7 | 27,2 | 29,4 | 67,6 | 75,6 | 78,6 | 93,5 | 101,2 | 108,2 |
| *20-25 April* | Control (without fertilizer) | 13,8 | 16,2 | 18,8 | 45,0 | 48,2 | 50,2 | 70,3 | 73,5 | 76,6 |
| | Manure 10 t/ha (ground) | 15,2 | 18,3 | 20,2 | 48,2 | 50,6 | 53,2 | 73,5 | 77,4 | 82,3 |
| | Ground +$N_{30}P_{60}K_{30}$ | 18,3 | 21,7 | 22,5 | 53,2 | 56,2 | 58,3 | 77,2 | 85,2 | 90,6 |
| | Ground +$N_{60}P_{90}K_{60}$ | 20,2 | 24,5 | 25,8 | 58,2 | 63,7 | 65,2 | 85,5 | 90,5 | 96,3 |
| | Ground +$N_{90}P_{120}K_{90}$ | 19,3 | 22,7 | 24,2 | 56,5 | 60,1 | 63,4 | 79,1 | 88,2 | 93,2 |

As can be seen from the table, when sowing on April 1-5, in the control (without fertilizer) variant, the height of soybean plant was in 45 true leaf stage is 45x5 cm, in the sowing scheme 15.5-16.5 cm, in 45x10 cm 17.8-18.6 cm, 18.5-19.7 cm in 45x15 cm and at full maturity, respectively; 71.3-72.5; 75.6-78.3 and 80.3-82.5 cm. In the 10 t/ha (ground) version of manure, these indicators are 16.8-18.3; 18.5-20.7; 19.8-21.5 cm in 4-5 true leaf stages, respectively; and 74.8-75.6; 81.8-83.6; 85.6-87.8 cm.at full maturity;

As a result of the application of different norms of mineral fertilizers together with manure, the length of soybean was higher than the control and manure options of 10 t/ha. Thus, in the variant of ground + $N_{30}P_{60}K_{30}$ in 4-5 true leaf stages 18.3-20.5 cm in 45x5 cm, 20.5-22.1 cm in 45x10 cm, 21.5-23.8 in 45x15 cm, at full maturity respectively;81.3-83.5, 88.5-91.7 and 93.1-97.5 cm, and the highest values are 20.5-22.3 cm in 45x5 cm and 22. 8-24.3 cm, in 45x10 cm and 24.3-26.1 cm in 45x15 cm in 4-5 true leaf stages in the ground + $N_{60}P_{90}K_{60}$ variant. It was respectively 88.6-90.6; 95.2-99.3; 101.5-105.8 cm in full maturity. As the mineral fertilizer norms increased with the soil (N90P120K90), the height decreased.

As can be seen from the table, when sowing on April 10-15, in the control (fertilizer-free) variant, the height of the soybean plant in the stage of 4-5 true leaves is 45x5 cm, in the sowing scheme 16.8-17.5 cm, in the 45x10 cm 20.5-22,8 cm, 21.8-23.7 cm in 45x15 cm and in full maturity, respectively75.5-79.6; 79.6-83.3 and 82.1-85.6 cm. At 10 t/ha (ground) of manure, these indicators are respectively 17.5-18.8; 21.7-23.5; 23.2-25.1 in 4-5 true leaf stages, and 79.8-81.5; 85.3-89.6; 87.6-90.7 cm in full maturity.

As a result of application of various norms of mineral fertilizers together with manure, soybean height was higher than control and manure 10 t/ha variants. Thus, in the variant of ground + $N_{30}P_{60}K_{30}$ in 4-5 true leaf stages 19.8-20.7 cm in 45x5 cm, 23.6-26.7 cm in 45x10 cm, 25.4-28.2 in 45x15 cm , full maturity respectively 85.6-87.5; 93,6-96,7 and 98,3-101,5 cm, and the highest indicators are 22,6-23,5 cm in 45x5 cm, 25.5-28.3 cm in 45x10 cm, 27.7-30.1 cm in 45x15 cm in 4-

Т. 7. №5. 2021
https://doi.org/10.33619/2414-2948/66

5 true leaf stages in the ground + $N_{60}P_{90}K_{60}$ variant. In full maturity it was respectively 92.8-98.3; 103.0-108.6; 108.2-115.7 cm. As the mineral fertilizer rates increased with the soil, the height decreased ($N_{90}P_{120}K_{90}$) as during the first sowing.

As can be seen from the table, when soybean was sown on April 20-25, in the appropriate sowing schemes and fertilizer norms, the height decreased compared to the 1st and 2nd sowing periods. This can be attributed to the late sowing. According to the stages of development, the highest height of soybean was observed in all three sowing schemes and fertilizer norms in the sowing carried out on April 10-15.

*Conclusion*

Thus, nutrient content, sowing time, and manure fertilizer norms have a significant effect on soybean height. When the optimal sowing period of soybeans was carried out on April 10-15, in all three sowing schemes, the plant height increased compared to early and late sowing (April 1-5 and 20-25) in all variants. The best results were obtained in the variant of manure 10 t/ha + $N_{60}P_{90}K_{60}$, the height of the plant at the end of the vegetation was 17.3-18.7 cm in the sowing scheme 45x5 cm, 23.4-25.3 cm in the size 45x10 cm and 26.1-30.1 cm in 45x15 cm compared to the control variant which had a significant impact on the formation of more leaf surfaces and branches, which in turn had a significant effect on productivity. Along with the soil, the reduced and increased norms of mineral fertilizers did not affect the soybean length much.

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