ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889, 2024-6.875 ResearchBib IF: 10.25 / 2025

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-6, ISSUE-3

EFFECT OF SOWING TIMING ON SOYBEAN YIELD

Ilxom Abdullayev, Assistant professor in Termez State University of Engineering and Agrotechnology, (Uzbekistan Republic, Surkhandarya region, Termez city, Islam Karimov street 288a)

Ishmuratov Shavkat, Doctor of Philosophy Agricultural Sciences (PhD), Senior Lecturer in Termez State University of Engineering and Agrotechnology, (Uzbekistan Republic, Surkhandarya region, Termez city, Islam Karimov street 288a), Email: mirkomil.2020@umail.uz.

Abstract. *Choosing the optimal sowing dates for soybean seeds is of great importance for obtaining high grain yields. The study examined the influence of sowing dates and application of bentonite clay along with mineral fertilizers on soybean yield. Soybean seeds were sown on March 20-25, April 5-10, and April 20-25. Bentonite clay was applied during the soybean growth period along with mineral fertilizers at a rate of 250 kg/ha during the branching stage, 250 kg/ha during the flowering stage, and 250 kg/ha at the beginning of the pod formation stage, totaling 750 kg/ha. Field germination of seeds in the variant sown on March 20-25 was 85.3%, while in the variant sown on April 20-25 it was 78.3%. Field germination in the variant sown on April 5-10 was 87.2%, and a high yield indicator was also noted, with a grain yield of 26.3 centners/ha obtained. When bentonite clay was applied, an additional grain yield of 4.7 centners/ha (15%) was obtained.*

Keywords: *sowing dates, "Nafis," field germination, bentonite clay, leaf surface, pod, mineral fertilizers, yield.*

INTRODUCTION. Currently, in many countries around the world, considering the population's need for protein, the area cultivated with soybeans is expanding. At the same time, significant attention is being paid to implementing new agrotechnologies to increase its yield. In this regard, several scientific researches are being conducted by scientists.

Choosing the correct sowing date plays an important role in the good growth and development of soybeans and in achieving high grain yield. Also, the application of bentonite clay along with mineral fertilizers during the soybean growth period improves the soil's moisture retention capacity and the plant's efficiency in assimilating mineral fertilizers.

The biological yield soybean varieties changes annually depending on sowing dates and other agrotechnical measures, as well as annual precipitation. Before sowing soybean varieties, it is necessary to thoroughly study their biological characteristics as a variety, their early, mid, and late maturity, and draw conclusions based on this. Experiments have shown that soybean plants, like other crops, belong to the type of crops that do not require major agrotechnical measures (Litvinov et al. 2006).

According to F.M. Kuperman, the sowing time and rate of soybean varieties affect not only the yield quantity and yield component indicators but also the growth period. When sown sparsely, soybean plants become shorter in height with more lateral branches and more pods on the stem. When sown very early, the failure of seedlings to emerge and the plants becoming frail can lead to a decrease in the field germination of productive varieties and, as a result, a decrease in yield (Kuperman,1969: 43).

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889, 2024-6.875 ResearchBib IF: 10.25 / 2025

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-6, ISSUE-3

According to the emphasis of L. Khalilova and B. Kuldoshev, when repeatedly sown soybean varieties Avanta, Amigo, Arleta, Sparta, and the local Orzu variety were studied by sowing at three different times, on July 1, July 16, and August 1, a decrease in plant height, number of pods per plant, height of the first pod placement from the soil surface, growth period, 1000-grain weight, and yield was observed in all varieties as the sowing dates were delayed (Khalilova, Kuldoshev, 2018: 62-63).

According to the results of research conducted by Nick R., Bateman, Angus L. Catchot and others, different soybean sowing dates affected the length or shortness of the growth period. In the research, soybeans were sown and studied on March 25, April 20, June 2, and July 25. Here, a reduction in the growth period from 122 days (March 25) to 83 days (July 15) was observed (Nick, Bateman, Catchot, 2020: 596).

Based on the results of research conducted by D.S. Gavrilin and S.I. Polevshchikov, they emphasize that sowing dates affect the 1000-grain weight of soybeans. When local and foreign soybean varieties were studied by sowing at different dates (20.04; 30.04; 10.05; 20.05; 30.05; 10.06), the 1000-grain weight in the local Soer-5 variety sown on April 30 was 174.5 g, while in the foreign Tanais variety, this indicator was 178.6 g when sown on May 20, marking the best result (Gavrilin, Polevshchikov, 2015: 9-15).

G. Shobolov, V. Gerus, V. Tsagareishvili and S. Bashura emphasized that the application of bentonite clay to the soil under plowing improves its bulk density, increases porosity, and due to its adsorbent properties, it retains moisture in the soil for a long time when the plant is irrigated, and as a cheap natural raw material with its other physico-chemical properties, it holds specific importance in world science (Shobolov, 1968: 26-31), (Gerus, 1972: 18-21), (Tsagareishvili, Bashura, 1980: 29-36).

MATERIALS AND METHODS

Scientific research work was carried out in 2021-2023 on irrigated takyr-meadow soils conditions at the Ingichka Fine-Fiber Cotton Growing Research Institute of Termez district.

In the field experiment, the influence of different sowing dates and application of bentonite clay on the growth and development, dry mass accumulation, net photosynthetic productivity, and yield of the soybean variety "Nafis" was studied. In the experiment, the Nafis variety of soybean was studied by sowing at different dates (20-25.03; 5-10.04; 20-25.04;). In agrochemical soil analyses, humus content (%) was determined by the Tyurin method, total nitrogen, phosphorus, and potassium (%) by Mal'tsev-Gritsenko, N-NO~3~ (mg/kg) by the Grandval-Lajoux method on FEC, available phosphorus by B.P. Machigin and exchangeable potassium by P.V. Protasov method (mg/kg), soil pH in aqueous suspension by potentiometric method.

Table 1

Experiment Scheme

№	Sowing Date	Sowing Rate, thousand seeds/ha*	Bentonite Application Rate, kg/ha*	Mineral Fertilizer Rate, kg/ha		
				N	P	K
1	March 20-25	350 (50 kg)	-	60	90	60
2		350 (50 kg)	750	60	90	60
3	April 5-10	350 (50 kg)	-	60	90	60
4		350 (50 kg)	750	60	90	60

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889, 2024-6.875 ResearchBib IF: 10.25 / 2025

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

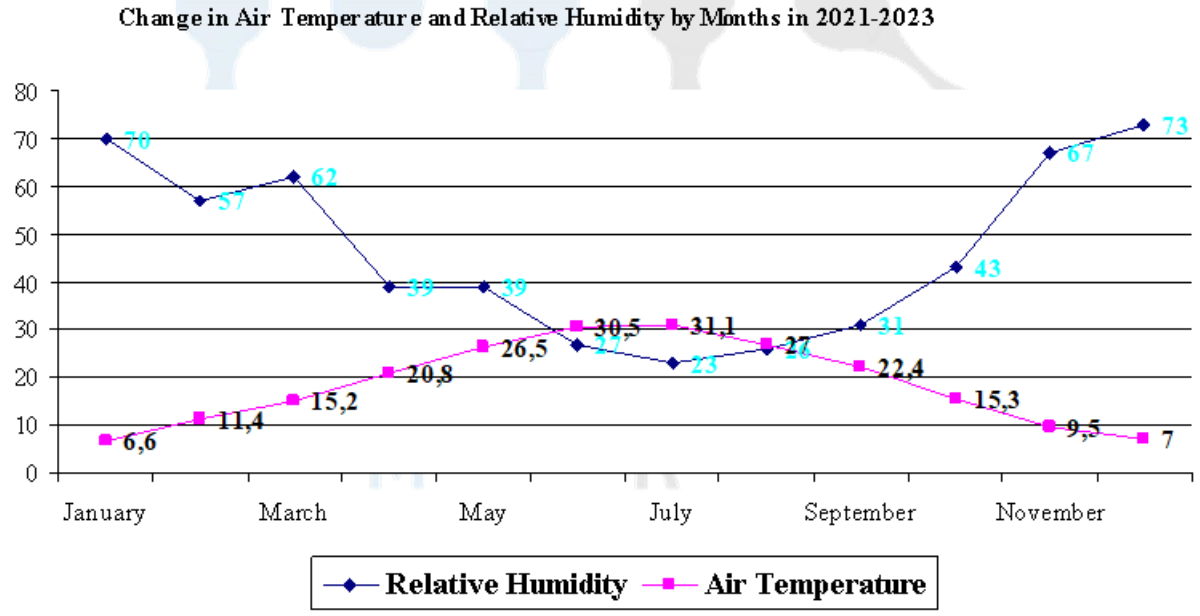
VOLUME-6, ISSUE-3

5	April 20-25	350 (50 kg)	-	60	90	60
6		350 (50 kg)	750	60	90	60

In the experiment, ammonium nitrate (34% N) was used as nitrogen fertilizer, ammophos (11% N, 46% P~2~O~5~) as phosphorus fertilizer, and potassium salt (54% K~2~O) as potassium fertilizer. Mineral fertilizers were applied based on given recommendations. Bentonite clay was applied along with mineral fertilizers at a rate of 250 kg/ha during the branching stage, 250 kg/ha during the flowering stage, and 250 kg/ha at the beginning of the pod formation stage, totaling 750 kg/ha during the growth period.

In the field experiment, systematic (periodic) phenological observations and biometric measurements were carried out during the branching, flowering, pod formation, and ripening phases. Seed emergence and field germination were determined per 1 linear meter in plots. Phenological observations were carried out in each experimental plot in counted rows at all plant development stages. Plant leaf area, dry mass, and net photosynthetic productivity were determined based on two replications by taking 5 plants per plot, at all development stages based on "Methodological guidelines for accounting and control of the most important indicators of photosynthetic activity processes of plants in crops" (A.A. Nichiporovich, Moscow 1969).

The weather conditions during the research years were specific. In November and December 2020, a decrease in air temperature to +10-+12 °C was observed. The highest temperature was +18-+20 °C. Air temperature at the beginning of 2021 was relatively moderate, +13-+14 °C in March, and +20-+21 °C in April, and uniform seed emergence was ensured in variants sown on March 20-25 and April 5-10. The rise in air temperature in the



last ten days of April (38.5 °C) negatively affected the emergence of seeds in the variant sown on April 20-25, leading to a decrease in field germination.

In May, the lower amount of precipitation and the average temperature of +35-+36 °C provided sufficient moisture and temperature for good soybean development. It is worth noting that in 2021, an unusual spring climate was observed compared to other years.

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889, 2024-6.875 ResearchBib IF: 10.25 / 2025

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-6, ISSUE-3

The sharp rise in temperature in the third ten days of June and the first and third ten days of July, and the continuous blowing of dry and hot dry winds for 3-4 days, and the decrease in relative humidity to 9-10% negatively affected the growth, development, and yield accumulation of soybeans among all types of crops, and the wrinkling of some grains in the pods was observed.

In the second year of the experiment (2022), the average air temperature in March being 10-12 °C negatively affected the emergence of seeds sown on March 20-25. Frequent rainfalls observed in the first half of April and the relatively low temperature also negatively affected the emergence of seeds in the variant sown on April 5-10. In the conducted research, additional nutrition with bentonite clay increased soybean resistance to extreme conditions, leading to better accumulation of yield components and, as a result, relatively good yield.

RESULTS AND DISCUSSION

In the experiment, the soybean variety "Nafis" was sown and studied. During the research years, the field germination of seeds changed depending on soil and air temperature, relative air humidity, and sowing dates.

According to the obtained results, during the research years, the air temperature on March 20-25 averaged +19.6 °C, the temperature in the 0-10 cm soil layer was +13.7 °C, and the field germination of soybean seeds was 85.3%. When soybean seeds were sown on April 5-10, the emergence period of seedlings coincided with the second and third ten days of April, during which the air temperature was noticeably higher and moderate, and no cooling conditions were observed. The average daily temperature was +21.2 °C, soil temperature was +15.8 °C, and field germination per hectare was 87.2%.

When the sowing date was delayed from April 5-10 to April 20-25, an increase in average daily temperature and a sharp decrease in relative air humidity, characteristic of the southern districts of Surkhandarya region, were observed. As a result, a rapid decrease in soil moisture, insufficient water required for soybean seed emergence, and a decrease in seed field germination were noted.

When soybean seeds were sown on April 20-25, the emergence period of seedlings coincided with the end of the third ten days of April and the beginning of the first ten days of May. During this time, soil temperature was +18.5 °C, average daily temperature was +24.8 °C, and relative air humidity was 32%. It was determined that the field germination of seeds decreased by 8.6% compared to variants sown on April 5-10, amounting to 78.3%.

Also, depending on the sowing date, the emergence period of seeds varied. For example, when soybean seeds were sown on March 20-25, the full emergence period of seedlings was in the first ten days of April, with an average daily temperature of +19.7 °C, maximum temperature +26.0 °C, and minimum temperature +5.1 °C. The period from sowing to full emergence of seedlings was 13 days (Figure 1).

With the rise in air temperature, seedling emergence also accelerated. When sown on April 5-10, seedlings emerged on average 10 days later, 2 days earlier than those sown on March 20-25. During this time, the average temperature was +22.1 °C, maximum temperature +31.2 °C, and minimum temperature +10.4 °C.

Here, the fact that seedlings emerged two days earlier compared to the variant sown on March 20-25 can be explained by the air temperature in the second ten days of April being somewhat warmer than in March. Because, when sown on April 20-25, seedlings emerged in 7 days. During this period, the

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889, 2024-6.875 ResearchBib IF: 10.25 / 2025

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-6, ISSUE-3

average air temperature was +26.8 °C, the highest temperature was +35.8 °C, and the lowest temperature was +14.2 °C.

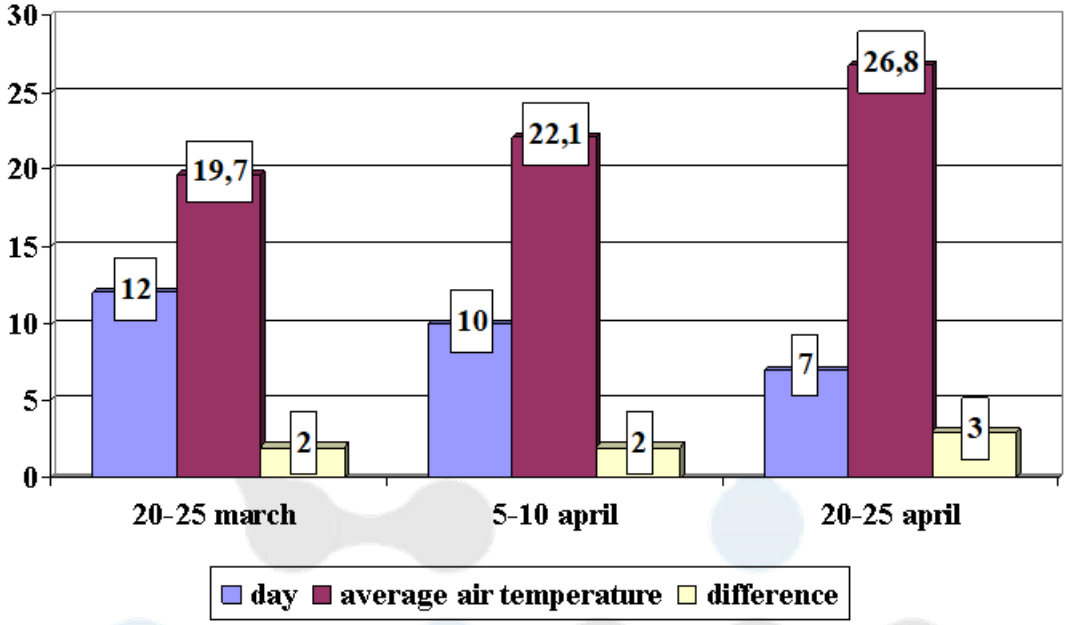


Figure 1. Duration of soybean seed emergence depending on sowing dates.

In the experiment, soybean grain yield varied depending on sowing date and bentonite clay application. In the variant sown on March 20-25 without bentonite clay application, the average was 19.1 centners/ha, in the variant sown on April 5-10 it was 26.3 centners/ha, and in the variant sown on April 20-25 it was 23.1 centners/ha. As a result of bentonite clay application, yield increased by 2.1-5.0 centners/ha, being 21.8; 31.0; 27.1 centners/ha according to sowing dates, respectively.

Table 2

Influence of Sowing Date, Rates, and Bentonite Clay on Soybean Grain Yield (2021-2023)

№	Sowing Date	Bentonite Application Rate, kg/ha	Grain Yield by Years, centners/ha			Average Grain Yield, centners/ha	Difference Compared to Without Bentonite, centners/ha
			2021	2022	2023		
1	March 20-25	-	19,9	17,7	19,7	19,1	-
2		750	22,4	20,6	22,3	21,8	2,7
3	April 5-10	-	27,3	23,9	26,7	26,3	-
4		750	31,9	28,8	31,3	31,0	4,7
5	April 20-25	-	24,0	22,2	24,9	23,1	-
6		750	28,1	24,8	28,4	27,1	3,1
General LSD_{05}			1,36	1,71	1,52		
Factor A LSD_{05}			1,87	1,58	1,37		
Factor B LSD_{05}			1,87	1,58	1,37		
Sx%			4,3	3,8	4,1		

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889, 2024-6.875 ResearchBib IF: 10.25 / 2025

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-6, ISSUE-3

CONCLUSION

During the soybean growth period, plant height changed depending on sowing date and additional nutrition with bentonite clay, and during the ripening period, when sown on March 20-25 it was 80.1-90.3 cm, when sown on April 5-10 it was 82.4-94.1 cm, and when sown on April 20-25 it was 79.3-91.4 cm, with the highest indicators obtained when sown on April 5-10, being 2.7-3.8 cm higher.

When soybean seeds were sown per hectare on April 5-10, during the branching, flowering, and pod formation stages, the number of leaves was 15.2; 19.7; 32.7 and the area was 336; 589; 1173 cm^2, while when soybean was sown at early or late dates, the number of leaves increased by 3-5, area by 79-137 cm^2, and when bentonite clay was applied along with mineral fertilizers, the number of leaves increased by 1.4-8.7 and area by 37-110 cm^2.

Sowing date and the application of bentonite clay as an additional nutrient specifically affected the productivity of the Nafis soybean variety, with the highest results obtained when sown on April 5-10: number of pods per plant 34.5, number of grains per pod 2.8, weight 0.41 g, 1000-grain weight 149.7 g.

Grain yield obtained when soybean was sown on March 20-25 was 19.1-21.8 centners/ha, when sown on April 5-10 it was 26.3-31.0 centners/ha, and when sown on April 20-25 it was 23.1-27.1 centners/ha. The highest yield was obtained when sown on April 5-10 at 350 thousand seeds/ha and bentonite clay was applied as an additional nutrient at a rate of 750 kg/ha, producing an additional 5.0 centners/ha yield.

REFERENCES:

1. Litvinov V.D., Sevostyanov A.A. (2006) Vozdelyvanie soi v usloviyakh ZAO "Davydovskoye" Leninskogo rayona Voronezhskoy oblasti [Soybean cultivation in the conditions of ZAO Davydovskoye in the Leninsky district of the Voronezh region], Voronezh: Voronezhnaya pechat.
2. Kuperman F.M. (1969) Fiziologiya sel'skokhozyaystvennye rasteniy [Physiology of agricultural plants]. Moskva. pp 43-45.
3. Khalilova L., Kuldoshev B. (2018) Takroriy ekish muddatlarida yangi soya navlarining o'sishi, rivojlanishi va hosildorligi [Growth, development and yield of new soybean varieties during repeated planting periods], Tashkent: Tashkent Agrarian University Press.
4. Nick R., Bateman Angus., Catchot L. (2020) Effects of Planting Date for Soybean Growth, Development, and Yield in the Southern USA. Agronomy journal, no 3, pp. 596-598
5. Gavrilin D.S., Polevshchikov S.I. (2015) Vliyanie srokov poseva na urozhaynost' i posevnye kachestva semyan sortov soi otechestvennoy i zarubezhnoy selektsii v usloviyakh Tambovskoy oblasti [The influence of sowing dates on the yield and sowing qualities of seeds of soybean varieties of domestic and foreign selection in the Tambov region]. Nauchno-proizvodstvennyy zhurnal Zernobobovye i krupyanye kul'tury. Rossiya, no 3, pp 9-15
6. Shobolov P.S. (1968) Razmeshcheniye mestorozhdeniy bentonita novykh montmorillonitovykh glin mira [Location of bentonite deposits of new montmorillonite clays in the world] Turkmenskogo polimekhanicheskogo instituta. Ashkhabad, no 5, pp 36-41
7. Gerus V. (1972) Bentonit na rynke kapitalisticheskikh stran [Bentonite in the market of capitalist countries], Moscow: Dom intellektual'noj knigi.

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889, 2024-6.875 ResearchBib IF: 10.25 / 2025

VOLUME-6, ISSUE-3

8. Tsagareishvili V.G., Bashura S.G. (1980) Poverkhnostno-aktivnyye veshchestva, vysokomolekulyarnyye soyedineniya i dispersnyye sistemy primeneniya v farmatsii [Surfactants, high-molecular compounds and dispersed systems for use in pharmaceuticals], Tbilisi: