European Journal of Agricultural and Rural Education (EJARE)
Available Online at: https://www.scholarzest.com
Vol. 4 No. 02, February 2023
ISSN: 2660-5643

SCIENTIFIC BASIS FOR THE USE OF BENTONITE IN AGRICULTURE

Kurbanov Fazliddin Nuriddinovich
Teacher, Bukhara State University, Bukhara, Uzbekistan
Rakhimova Gulnoza Yomgirovna
Master's Student, Bukhara State University, Bukhara, Uzbekistan

Article history:

Received: 24th December 2022
Accepted: 24th January 2023
Published: 28th February 2023

Abstract:

The scientific aspects of the use of bentonite in agriculture are described in detail in the article. Information is given on the chemical composition of bentonite and the positive aspects of its use in cotton cultivation. Bentonite treatment of cotton seeds in the conditions of saline soils increased yield and quality indicators.

Keywords: Bentonite, cotton varieties, soil salinity, soil fertility, trace elements, productivity.

INTRODUCTION

In agriculture, it has been studied that the use of non-traditional agro-ores as additional nutrients gives good results in maintaining and increasing soil fertility. It is known that the reduction of organic substances in the soil, especially humus, sharply reduces the effectiveness of synthetic fertilizers used to obtain high yields from crops. In mitigating the shortage of mineral and local fertilizers, non-traditional agro-ores glauconite, phosphorite and bentonite slurries are rich in many micro- and macro-elements.

Bentonite clay, which is considered one of the non-traditional agro-ores, can be used as fertilizers in agriculture due to the level of provision of macro- and micro-elements in the soil in optimal proportions. Microelements have a high agrochemical and physiological importance, they improve metabolism, help the physiological and biochemical processes to pass optimally, have a positive effect on the process of chlorophyll synthesis and increase the speed of photosynthesis. Under their influence, plants become more resistant to fungal and bacterial diseases, one of the unfavourable environmental conditions is the lack of moisture, temperature rise or fall.

In the conditions of our republic, growing a stable, high-quality crop from cotton is the backbone of our economy, and the main part of the foreign exchange earnings is provided by the export of cotton fibres. Also, the development of many branches of agriculture and industry is directly related to the cotton sector. From this point of view, it is important to increase the production of raw cotton, reduce consumption costs by 30%, increase productivity by 20%, to develop and modernize agrotechnical measures for growing high yields in accordance with modern conditions, despite the disadvantages of natural climatic conditions.

It is known that physiologically active substances have a specific effect on the photosynthesis process, enzyme activity, amino acid, nucleic acid and protein biosynthesis, phytohormone exchange process in cotton metabolism, increase the germination capacity and fertility of seeds, increase tolerance to drought, salt and diseases, and have a positive effect on the rapid growth of the plant. , accelerates the ripening of crops and increases productivity and product quality.

MATERIALS AND METHODS

Meadow-alluvial soils of the Bukhara region, bentonite mud from Navbahor deposits, encapsulated seed, local and mineral fertilizers, cotton, and non-traditional agro-ores, the effect of encapsulated seed with bentonite mud on the growth and productivity of cotton is studied.

The main goal of the scientific work is to study the effect of planting seeds encapsulated with Bentonite mud on cotton growth and yield in different cotton varieties.

Many scientists in our country and abroad have carried out scientific research on the use of non-traditional agro-ores in agriculture. In particular, agro-ores have been found to have a wide influence on physiological and biochemical processes in plants.

Scientific research has been conducted on the fact that bentonite and glauconite agro-ores improve the mechanical structure of the soil, as a catalyst in the physiological processes of plants, in photosynthesis, metabolism, and disease resistance.

It was determined that when bentonite slurry is added to the soil at different rates and periods, the water-physical properties of the soil are improved, seasonal water consumption is saved, cotton wilt and root rot diseases are reduced by 25-40%, and cotton yield is increased by 14.2-20.6%. [1].

RESULTS AND DISCUSSION

It should be noted that scientific work has been carried out on the effect of various non-traditional agro-ores and composts prepared based on them on the productivity of cotton and cotton-complex crops, however, the novelty of the scientific work is that in the conditions of meadow-alluvial soils of the Bukhara region, the seeds of various cotton varieties were encapsulated with a bentonite slurry solution. the effect of sowing on the dynamics of cotton germination and the speed of development phases and yield is determined.

It has been proven that sowing seeds encapsulated with non-conventional agro-ore bentonite slurry accelerate the germination of cotton seedlings by 1-2 days, increases the weight by 10-12% and increases the yield by 2.2-2.7 5 t/ha.

During the processes of cotton ontogeny and under the influence of various agrotechnical measures, crop elements are rapidly formed in plants. But under the influence of extreme conditions, failure to follow the scientifically based ratio of mineral fertilizers application or low rate, due to lack of water or excessive moisture and poor quality of agrotechnical measures, due to the influence of diseases and harmful insects, the loss of crop elements is observed, as a result of which the yield of crops decreases and the quality of products decreases. If 1-2 more bolls are preserved or gathered in one bush of cotton, the yield will increase by 3-4 t/s or it will allow the growing of several 100 thousand tons of additional cotton crop in our Republic. Our goal is to determine how effective bentonite powder is on cotton yield and to introduce it widely in farms.

Therefore, to reduce the spillage of crop elements that appear during the development periods of cotton under the influence of external factors, and to increase productivity and product quality, it is important to study the effect of local raw bentonite powder on cotton and develop optimal application technology in the conditions of our republic.

As a result of the solution to this problem, cheap, ecologically clean new agricultural products will be developed locally, and new jobs will be created in the enterprise that produces it, which will be a solution to problems such as localization of industrial production, modernization of enterprises and opening of new jobs promoted by the leader of our country.

In the mineral content of bentonite clay, montmorillonite reaches 80 per cent. The amount of secondary mineral hydromica is 10-25 per cent. Quartz, cristobalite, iron hydroxides, calcite, palygorskite, pallasite, auntie, jarosite, etc. are found as additions [2].

At the final stage of the research, the effect on the germination, growth and development of the seeds encapsulated with bentonite powder and on the yield will be determined. Recommendations are given to farms on the application of bentonite powder to seed. Agrotechnical activities of cotton cultivation are improved and modernized based on the application of bentonite. This makes it possible to reduce the spillage of crop elements, improve plant growth and development, grow early, high-quality crops, and implement resource-saving, economically efficient agrotechnology.

Bentonite is successfully used in many countries of the world: Czechoslovakia, Italy, the USA, Egypt, Ukraine, Georgia, Russia, Japan, China, etc., it allows to increase in the yield of crops by 20-32.6% and improves the quality of products. Field experiments with bentonite in Czechoslovakia show that bentonite prolongs the action of organic fertilizers and increases their effectiveness.

In recent years, several scientists have worked on the use of non-traditional agro-ores in agriculture. It has been determined that agro-ores have a wide influence on physiological and biochemical processes in plants [3].

Kyzylkum proved that the presence of organic acids in composts made based on phosphorite and manure can increase the useful level of phosphorite and significantly reduce the amount of local manure that should be applied to the soil [4].

It improves the soil mechanical composition of agro-ores, and is important as a catalyst in the physiological process of plants, in photosynthesis, metabolism, and resistance to diseases. Boltaev S.M. carried out scientific work on the effect of composts made based on Khovdak bentonite and local manures on soil fertility, cotton and cotton-complex crops in different soil and climate conditions, but no experiments were conducted on the effect of organometal composts as an ameliorant [5].

At the same time, the soil structure also improved, which in turn led to the rapid growth of shoots. In addition, the addition of bentonite residues to insecticides, fungicides and corn silage has been effective. Studies on the use of bentonite clay to increase the productivity of light sod-podzolic soils have been conducted in Tatarstan. The following doses of bentonite clay were used in the experiments: 3, 5, 8 and 10 t per 1 hectare of cultivated area. In the experimental options, the repetitions are of three types, and they are placed in different layers [6].

In Kazakhstan, in 1986, N.M. Ivkin, V.A. Sokolov worked on the application of bentonite clay to sweet potato, potato, corn, tomato, cucumber, cabbage, onion, grape and alfalfa plantations, from 150 to 300 kg per hectare of land. bentonite is added; the yield of potato increased by 45%, alfalfa by 1.7-35.5%, sugar beet by 46.5%, tomato by 35.4%, cabbage by 31.3%. The most important thing is that the harvest ripens 10-15 days earlier, and the vegetables accumulate more vitamins and sugar.

The application of silage technology using bentonite clay by farmers in northeastern Thailand has significantly reversed soil degradation and brought economic benefits with high profitability. A 2002-2003 study by the International Water Management Institute and partners focused on the application of bentonite clay to local farmers' fields on degraded soils in the region. These measures were used in field trials. The results of the research showed that the quality of the product obtained from sorghum grown using only rainwater was higher when bentonite clay was used. Farmers who used bentonite clay achieved high-quality products compared to other farmers [7].

In addition, to improve plant nutrition with micronutrients, they used bentonite clay as a sorbent, which gave better results when used in combination with manganese and molybdenum micro fertilizers with a small amount of boron.
Saline soils mainly contain 12 types of water-soluble salts, which cause a decrease in soil fertility and crop yields. In saline soils, the water used for salt washing is 2-3 times more than the water used for one irrigation of crops. It is also important to use chemical preparations that increase the solubility of salts in the soil to save fresh water used for salt washing.
Also, the chemical ameliorant firmly settles in the soil, displaces hard-to-dissolve cations, and accelerates their absorption into the soil solution. These settle and coagulate, and the remaining water-soluble anions and cations dissolve in water and are washed down from the active layer of the soil. In this way, the process of desalination takes place in the soil. In the options where chemical ameliorants were used, 2112m^3 of water was used instead of 4000m^3 for washing the salt in the driving layer in conditions of moderately saline soils [8].
Planting phytomeliorant plants on saline soils, mainly in fields empty of winter wheat, in conditions of water shortage, reduces the amount of water-soluble harmful salts in the soil layers and also causes a sharp reduction in the amount of water used for salt washing in the season. In the conducted scientific and research works, it was proved that when the white sorghum (sorghum) phytomeliorant was planted on the land freed from grain, the amount of water used for salt washing in autumn was 2392m^3/ha less compared to the option left as a plough [9].
Today, the level of nutrient supply of the soil of our Republic is as follows: The amount of mobile nitrogen in the composition is 20mg/kg, that is, the increase of the lands with very low supply is 4%, the lands with a low level of 20-30mg/kg have increased by 10%. Areas with a soil content of 50-60mg/kg decreased by 6%, areas with a high supply of more than 60% decreased by 2.5%, as well as lands with a low supply of phosphorus with a content of 30mg/kg of mobile phosphorus - 6%, with a high level - more than 45% areas decreased by 8%. Areas with a low potassium supply of less than 200 mg/kg had a 9-13% reduction.
Therefore, to change the nutrient balance in the soil in a positive direction, it is necessary to use not only mineral fertilizers but also additional sources. Including manure, industrial waste, fresh water turbidity, tree leaves, and non-traditional agro-ores as additional food and meliorant to the soil gives a very positive result [10-21].
Chronic failure to apply organic fertilizers to the soil leads to the deterioration of the soil's mechanical structure. The decrease in the porosity of the soil and the increase in volume mass leads to the deterioration of its field moisture capacity. When the soil has an average moisture content of 70% compared to the field moisture capacity, the water flow in the capillaries is interrupted, which makes it difficult for plants to absorb nutrients from the soil solution [22-36]. It can be concluded that unfavourable water-physical properties last for a long time in soils with heavy mechanical structures.
Nitrogen absorption by plants in saline soils is different, an increase in monovalent elements sodium and potassium in soil and solution composition activates nitrate nitrogen absorption by plants, but with an increase in divalent calcium and magnesium cations, nitrate nitrogen absorption decreases, ammonia and amide nitrogen are better absorbed.
More than 40 small bentonite minerals are found in nature, differing from each other in their physicochemical properties and chemical mineralogical aspects. Existing non-traditional mineral raw materials are significant for their high efficiency in replacing some missing mineral nutrients in agriculture or as additional nutrients due to their high availability and low cost.

CONCLUSION

World experience shows that bentonite and bentonite-like rocks, glauconite, etc. are multi-purpose raw materials, according to the distinctive features and composition of agro-ores, richness in various components, and physicochemical properties of absorption. Including:
- as a rich source of macro and microelements in plant nutrition;
- as an adsorbent, increasing absorption in the exchange of cations and anions, improving the water retention properties of the soil, as cleaners of soil and water from toxic chemical elements, heavy metals and radiation; as an ameliorant, reducing the number of harmful salts in the soil, improving the mechanical composition of sandy and loamy soils;
- as a catalyst in the physiological process of plants, it is important in photosynthesis, metabolism, respiration and increasing plant resistance to diseases.

REFERENCES

1. Джамалов А., Алимарданов Д. Изучение глауконитов против болезней хлопчатника. Научный отчет за 1978, Сурхандарьинская опытная станция СоюзНИХИ, 28 с.
2. Артыков А.А. Подотчет прогнозных ресурсов (по P_2) с разработкой технологического регламента селективной обработки щелочных бентонитов месторождения Логон с целью использования в сельском хозяйстве и выпуска нового экспортоориентированного наукоёмкого бентонитового материала – бентомата. Т. 2012, 8 стр.
3. Ахатов А. Ахатова Л.А "Суғориладиган бўз ўтлоқи тупроққа қўлланилган мелиорантларнинг тупроқ агрокимёвий хоссаларига таъсири."// Ўзбекистон пахтачилигини ривожлантирш истиқболлари номли Республика илмий–амалий анжумани материаллари тўплами.Тошкент-2014.Б. 220-222.

4. Ниязалиев Б.И. "Компостларни тайёрлаш ,сақлаш ҳамда агрокимёвий тавсилоти"// Ер ресурсларидан самарали фойдаланиш, тупроқ унумдорлигини сақлаш, қайта тиклаш ва ошириш йўллари. Республика илмий-амалий анжумани маърузалари тўплами. Тошкент-2012.Б-100-103.
5. Тунгушова Д.А., Болтаев С.М., Абдурахимова С.О., Белоусова Е.М. «Бентонит лойкасининг гузанинг усиши, ривожланиши ва хосилдорлигига таъсири.» «Пахтачилик ва дончиликни ривожлантириш муаммоллари» мавзусидаги халкаро илмий – амалий конференция маърузалари асосидаги маколалар тупалами. УзПИИТИ. Ташкент-2004,156-158 бет.
6. Қўзиев Р.К. "Ўзбекистоннинг жанубий минтақаларида турли хил тупроқларида бентонитлардан файдаланиш" // Ўзбекистондаги ноанъанавий агрорудаларни ишлаб чиқариш ва улардан қишлоқ хўжалигида фойдаланиш муаммоларига бағишланган илмий амалий семинар маърузалари тезислари. Тошкент 2000. Б. 8-9.
7. Тунгушева Д.А. и др. Эффективность применения нетрадиционных агрономических руд в хлопковом комплексе. // Материалы международной научно-прикладной конференции «Тупроқ унумдорлигининг оширишни илмий ва амалий асослари», Т-2007г., I часть, с. 112-115.
8. Тошқўзиев М, Очилов. С.Қ. Тупроқ унумдорлигини тиклаш ва оширишда уни органик моддага бойитиш агротехнологияларини фермер хўжаликлари шароитида қўллаш натижалари. Ер ресурсларидан самарали фойдаланиш, тупроқ унумдорлигини сақлаш, қайта тиклаш ва ошириш йўллари. Республика илмий-амалий анжумани маърузалари тўплами. Тошкент-2012.Б 24-29.
9. Хамидов М., Жўраев У.,.Хамраев К. "Фитомелиорант ўсимликларнинг тупроқ шўр ювиш меъёрларига таъсири" Ж.Ўзбекистон қишлоқ хўжалиги. № 2, 2016. Б. 39-40.
10. Саттаров Ж.С. Ўғит самарадорлигининг тупроқ физик хоссаларига боғлиқлиги. Ер ресурсларидан самарали фойдаланиш, тупроқ унумдорлигини сақлаш, қайта тиклаш ва ошириш йўллари. Республика илмий-амалий анжумани маърузалари тўплами. Тошкент-2012.Б-17-20.
11. Kholliyev A. E., Teshaeva D. R. (2022). Adaptation Characteristics of Autumn Wheat Variieties to Salinity Stresses. *Ra journal of applied research*. 8(3). 209-213.
12. Kholliyev, A., & Teshaeva, D. (2021). Soil salinity and water exchange of autumn wheat varieties. *Збірник наукових праць ЛОГОС*.
13. Kholliyev, A. E., Norboyeva, U. T., Kholov, Y. D., & Boltayeva, Z. A. (2020). Productivity of cotton varieties in soil salinity and water deficiency. *The American Journal of Applied sciences*, *2*(10), 7-13.
14. Toshtemirovna, N. U., & Ergashovich, K. A. (2019). Regulation of the water balance of the cotton varieties under salting conditions. *ACADEMICIA: An International Multidisciplinary Research Journal*, *9*(8), 5-9.
15. Ergashovich, K. A., Toshtemirovna, N. U., Rakhimovna, A. K., & Abdullayevna, F. F. (2020). Effects of microelements on drought resistance of cotton plant. *International Journal of Psychosocial Rehabilitation*, *24*(2), 643-648.
16. Маткаримов, Ў. М. (2006). Ер жамғармалари улардан фойдаланиш, сифатий баҳолаш ва муҳофазалаш масалалари. *Қишлоқ хўжалигида экологик муаммолар: Респ. ил. амал. матер.–Бухоро*, 203-204.
17. Строгонов, Б. П. (1973). *Метаболизм растений в условиях засоления: Доложено на тридцать третьем ежегодном Тимирязевском чтении 2 июня 1972 г.* Наука.
18. Кузнецов, В. В., Хыдыров, Б. Т., Рощупкин, Б. В., & Борисова, Н. Н. (1990). Общие системы устойчивости хлопчатника к засолению и высокой температуре: факты и гипотезы. *Физиология растений*, *37*(5), 987-996.
19. Morillon, R., & Chrispeels, M. J. (2001). The role of ABA and the transpiration stream in the regulation of the osmotic water permeability of leaf cells. *Proceedings of the National Academy of Sciences*, *98*(24), 14138-14143.
20. Neill, S., Desikan, R., & Hancock, J. (2002). Hydrogen peroxide signalling. *Current opinion in plant biology*, *5*(5), 388-395.
21. Patakas, A., & Nortsakis, B. (1999). Mechanisms involved in diurnal changes of osmotic potential in grapevines under drought conditions. *Journal of plant physiology*, *154*(5-6), 767-774.
22. Norboyeva, U. T. (2017). Kholliyev AE Salinification influence on physiology of water exchange in cotton plant varieties (Gossypiym HirsutumL.). *The Way of Science. International scientific jornal.–Volgograd*, (7), 41.
23. Norboyeva, U. T. (2018). Kholliyev AE soil salinity and saline tolerance of the sorts of cotton. *Mechanisms of resistance of plants and microorganisms to unfavourable environmental. Irkutsk*, 567-570.
24. Norboyeva, U. T. (2018). Kholliyev AE water interchange and saline tolerance of the sorts of cotton. *Mechanisms of resistance of plants and microorganisms to unfavourable environmental. Irkutsk*, 563-566.
25. Ergashovich, K. A., Toshtemirovna, N. U., Raximovna, A. K., & Abdullaevna, F. F. (2022). The Properties of Cotton Resistance and Adaptability to Drought Stress. *Journal of Pharmaceutical Negative Results*, *13*(4), 958-961.
26. Сказкин, Ф. Д. (1971). *Критический период у растений по отношению к недостатку воды в почве*. Наука. Ленингр. отд-ние.
27. Ergashovich, K. A., Toshtemirovna, N. U., Davronovich, K. Y., Azamatovna, B. Z., & Raximovna, A. K. (2021). Effects of Abiotic Factors on the Ecophysiology of Cotton Plant. *International Journal of Current Research and Review*, *13*(4), 4-7.
28. Ergashovich, K. A., Davronovich, K. Y., Toshtemirovna, N. U., & Azamatovna, B. Z. (2020). Effect of soil types, salinity and moisture levels on cotton productivity. *Journal of Critical Reviews*, *7*(9), 240-243.

29. Ergashovich, K. A., Azamatovna, B. Z., Toshtemirovna, N. U., & Rakhimovna, A. K. (2020). Ecophysiological effects of water deficiency on cotton varieties. *Journal of Critical Reviews*, *7*(9), 244-246.
30. Toshtemirovna, N. U., & Ergashovich, K. A. (2019). Physiology, productivity and cotton plant adaptation under the conditions of soil salinity. *International Journal of Recent Technology and Engineering*, *8*(2 S3), 1611-1613.
31. Ergashovich, K. A., Toshtemirovna, N. U., Iskandarovich, J. B., & Toshtemirovna, N. N. (2021). Soil Salinity And Sustainability Of Cotton Plant. *The American Journal of Agriculture and Biomedical Engineering*, *3*(04), 12-19.
32. Kholliyev, A., Norboyeva, U., & Jabborov, B. (2021). All about the water supply of cotton. *Збірник наукових праць SCIENTIA*.
33. Норбоева, У. Т. (2018). Водный обмен и солеустойчивость сортов хлопчатника. *Mechanisms of resistance of plants and microorganisms to unfavorable environmental*, 563-566.
34. Норбоева, У. Т. (2018). Почвенное засоление и солеустойчивость сортов хлопчатника. *Mechanisms of resistance of plants and microorganisms to unfavorable environmental*, 567-570.
35. Норбоева, У. Т. (2017). Физиологические адаптационные способности сортов хлопчатника Бухара-6 и Акдарья-6 к почвенной засухе. *Ученый XXI века*, (1-1 (26)), 37-40.
36. Норбоева, У. Т. (2017). О водных ресурсах биосферы и эффективном их пользовании. *Ученый XXI века*, *35*.