

**O‘ZBEKISTON RESPUBLIKASI OLIY TA’LIM, FAN VA
INNOVATSIYALAR VAZIRLIGI**

**MIRZO ULUG‘BEK NOMIDAGI O‘ZBEKISTON MILLIY
UNIVERSITETINING JIZZAX FILIALI**



KOMPYUTER ILMLARI VA MUHANDISLIK TEXNOLOGIYALARI
mavzusidagi Xalqaro ilmiy-texnik anjuman materiallari to‘plami
2026-yil 25-26-sentabr

(1-qism)

JIZZAX-2026

Kompyuter ilmlari va muhandislik texnologiyalari. Xalqaro ilmiy-texnik anjuman materiallari to'plami – Jizzax: O'zMU Jizzax filiali, 2026-yil 25-26-sentabr. 507-bet.

Xalqaro miqyosidagi ilmiy-texnik anjuman materiallarida zamonaviy kompyuter ilmlari va muhandislik texnologiyalari sohasidagi innovatsion tadqiqotlar aks etgan.

Globalashuv sharoitida davlatimizni yanada barqaror va jadal sur'atlar bilan rivojlantirish bo'yicha amalga oshirilayotgan islohotlar samarasini yaxshilash sohasidagi ilmiy-tadqiqot ishlariga alohida e'tibor qaratilgan. Zero iqtisodiyotning, ijtimoiy sohalarni qamrab olgan modernizatsiya jarayonlari, hayotning barcha sohalarini liberallashtirishni talab qilmoqda.

Ushbu ilmiy ma'ruza tezislari to'plamida mamlakatimiz va xorijlik turli yo'nalishlarda faoliyat olib borayotgan mutaxassislar, olimlar, professor-o'qituvchilar, ilmiy tadqiqot institutlari va markazlarining ilmiy xodimlari, tadqiqotchilari, magistr va talabalarining ilmiy-tadqiqot ishlari natijalari mujassamlashgan.

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Mazkur to'plamga kiritilgan ma'ruza tezislarining mazmuni, undagi statistik ma'lumotlar va me'yoriy hujjatlarning to'g'riligi hamda tanqidiy fikr-mulohazalar, keltirilgan takliflarga mualliflarning o'zlari mas'uldirlar.

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BIOTECHNOLOGICAL POTENTIAL OF BIOCHAR FOR SOIL CARBON SEQUESTRATION

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Abstract. This study examines the biotechnological potential of biochar for soil carbon sequestration. Biochar produced through the pyrolysis of agricultural biomass under oxygen-limited conditions, can contribute to long-term carbon storage in soil. Its application may improve soil properties, support microbial activity, and enhance soil organic carbon stabilization. Biochar therefore represents a promising approach for climate change mitigation and sustainable soil management.

Keywords: biochar, carbon sequestration, soil organic carbon, biotechnology, pyrolysis, microorganisms, soil fertility.

An increase in atmospheric temperature that results in climate warming and its corresponding effects on the ecosystem breeds the quest for environmental sustainability in controlling greenhouse gas emissions. Greenhouse gases, especially methane and carbon dioxide, originate majorly from microbial degradation of soil organic matter through carbon mineralization, respiration, and methanogenesis processes. Carbon mineralization occurs in the soil. The soil is perhaps considered the largest reservoir of carbon (organic and inorganic) in the biosphere. Most of these organic carbons originate from plants, which release approximately 50% of their fixed carbon (photosynthates) into the soil. The plant's root exudates (photosynthates and sloughed-off tissues) support microbial growth and metabolism, culminating in carbon dioxide production via respiration and methane production through methanogenesis. These microbial-mediated processes result in the loss of soil organic carbon (SOC) [1].

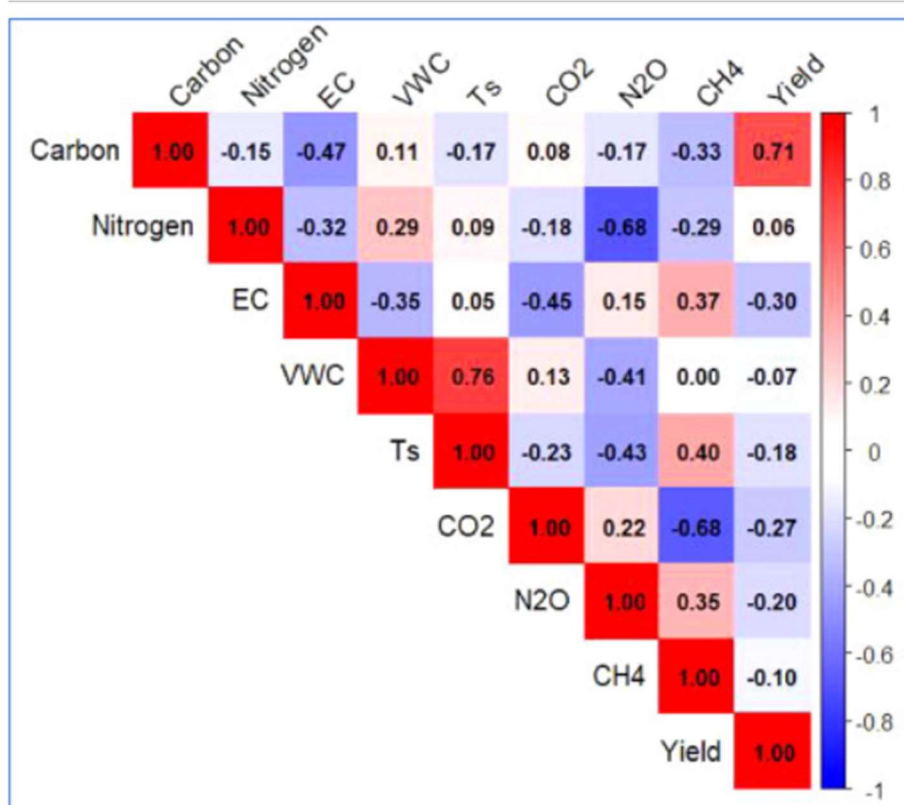


Fig. 1. Pearson correlation matrix of soil physicochemical properties, greenhouse gas emissions, and crop yield.

Biochar (also called black carbon) is a porous carbonaceous material which is obtained from plant biomass, woody materials, plant-based residues, etc. by thermal processes. The key thermal processes used for the synthesis of biochar include slow and fast pyrolysis, and these processes are conducted in a sealed container at an elevated temperature (100–1000 °C) under limited oxygen environment. Pyrolysis

of biomass results in the preservation of 50% of carbon in its original substrate which is highly stable and present in soil for longer time [2].

Evidence from sandy soils in China was mixed: some short-term experiments showed increases of ~7–9% in N_2O and CH_4 , whereas others reported neutral or minor effects on crop yields. In the United States, corn systems amended with biochar showed an 8% yield increase accompanied by modest increases in CO_2 and N_2O (6% each). In Iran, rice experiments produced yield-neutral results but a ~5% increase in CO_2 emissions, suggesting limited mitigation under those conditions [3].

Additionally, the soil's pH experienced a temporary decrease due to a rise in carbon content. Alterations in the soil biota directly impact the growth of plants. Multiple studies have shown that Mycorrhizal fungus exhibits a higher biochar growth propensity. Mycorrhizal fungi, which facilitate plant nutrient and water uptake, influence soil aggregates' formation and structural integrity. Bacteria may be drawn to the biochar, reducing their vulnerability to leakage. Introducing biochar to paddy soil led to a substantial 18-28% rise in microbial biomass carbon. Adding biochar, particularly in combination with nitrogen fertilizers, has enhanced the relative abundance of beneficial bacterial species such as *Acidobacteria* and *Proteobacteria* [4].

A field experiment was conducted to assess the effects of biochar application, with and without fertilizer, on GHG emission reductions and carbon sequestration potential in a sorghum field at Prairie View A&M University's research farm in the southern Great Plains of Texas, USA. Biochar application with full and reduced fertilizer application rates was found to reduce CH_4 , CO_2 , and N_2O fluxes from 5.5% to 12.4% [5].

Soil microorganisms are key drivers of carbon cycling, and within these communities, bacteria and fungi exist at abundances far exceeding those of other soil biota, typically dominating microbial biomass and diversity. Bacteria and fungi are directly involved in the carbon cycle, with microbial necromass carbon constituting a major C source contributing to the formation of stable soil organic matter (SOM). Moreover, microorganisms transform incoming organic substrates either into their own biomass or respire them as CO_2 , which is the critical switch determining whether carbon is sequestered or lost from the soil system [6].

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G'O'ZADA (*GOSSYPIMUM HIRSUTUM* L.) ABIOTIK STRESSLARGA EPIGENETIK MOSLANISH MEXANIZMLARINI TAHLIL QILISH

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Anotatsiya. G'o'za (*G. hirsutum* L.)da abiotik stresslarga moslanishida epigenetik mexanizmlar muhim ahamiyatga ega. DNK metillanishi, giston modifikatsiyalari va ncRNKlar stressga javob beruvchi genlarning faoliyatini boshqarish orqali o'simliklarning turli stress omillariga chidamliligini oshirishga yordam beradi. Ayrim epigenetik o'zgarishlar stress ta'siri tugaganidan keyin ham saqlanib, o'simliklarning keyingi stress sharoitlariga moslashishi va himoya mexanizmlarining shakllanishida muhim rol o'ynaydi. Shuningdek, ayrim o'zgarishlar avloddan-avlodga transgeneratsion tarzda o'tishi mumkin. Mazkur mexanizmlarni o'rganish stressga olib keladigan qishloq xo'jaligi navlarini olishda epigenetik seleksiya uchun muhim ilmiy asos bo'lib xizmat qiladi.

Kalit so'zlar; G'o'za (*G. hirsutum* L.), DNK metillanishi, giston modifikatsiyasi, ncRNK, lncRNK, abiotik stress, qurg'oqchilik, sho'rlanish.

G'o'zada turli stress omillariga tezroq va samaraliroq javob qaytarish maqsadida uzoq muddat saqlanadigan moslashuv mexanizmlari shakllangan. Ushbu jarayon davomida avvalgi stress ta'siri natijasida hosil bo'lgan epigenetik o'zgarishlar saqlanib qoladi va keyingi stress holatlarida himoya reaksiyalarining tezroq faollashishini ta'minlaydi. Stressga moslanish mexanizmlari somatik, avlodlararo va transgeneratsion (**bir necha avlodlar davomida saqlanib qoladigan biologik yoki epigenetik o'zgarishlar**) shakllarda namoyon bo'lishi mumkin. So'nggi tadqiqotlarda aniqlanishicha, stressga uzoq muddatli moslanish DNK metillanishi va giston modifikatsiyalari bilan chambarchas bog'liq ekanligini ko'rsatmoqda. Abiotik stresslar ta'siri natijasida yuzaga kelgan epigenetik o'zgarishlar ayrim hollarda keyingi avlodlarga ham uzatilishi mumkin.