Sher-e-Bangla Agricultural University

SDG Activity Report
on

SDG 15:
Life on Land

Contents

Faculty Research and Publications

River Waste to Goldmine: A Tale of Floating Agriculture in Vulnerable Southern Regions of Bangladesh

Author: Md. Syful Islam et al.

Year: 2025

Abstract: The freshwater prawn (Macrobrachium rosenbergii) constitutes an integral component of the aquaculture sector in Bangladesh, with biofloc technology (BFT) emerging as a sustainable and resource-efficient alternative to conventional farming methods. This study evaluated the comparative effects of three herbal extracts—ginger (GE), amla (AE), and garlic (GaE)—on the growth performance, survival rate, and nutritional composition of M. rosenbergii juveniles cultivated in a biofloc-based system over an eight-week period. Four experimental groups were established: a control (T1), GE (T2), AE (T3), and GaE (T4), with herbal extracts incorporated into commercial feed at a concentration of 200ml/ kg. Among the treatments, amla extract (T3) yielded the most favorable results, reflected in significantly higher mean weight gain (10.5 ± 0.5 g), percentage weight gain (275.5 ± 27.7%), and specific growth rate (2.6 ± 0.1%). The feed conversion ratio (FCR) was the lowest in T3 (0.8 ± 0.0), indicating superior feed efficiency. Proximate analysis of muscle tissue revealed that prawns in the AE group had the highest crude protein content (74.1%) along with optimal fat and fiber levels, highlighting its nutritional benefits. Additionally, the presence of biofloc improved water quality and performance metrics across all treatments compared to the control. These findings suggest that integrating amla extract with BFT can significantly enhance growth, feed utilization, and flesh quality in prawn aquaculture, offering an environmentally sustainable and economically viable strategy.

Insights Into the Mechanisms of Tonoplast Dicarboxylate Transporter-Induced Plant Tolerance Against Manganese Toxicity in Peach.

Author: Mirza Hasanuzzaman

Year: 2025

Abstract: Manganese (Mn) toxicity poses a severe hazard to plant growth, with organic acids playing a crucial role in detoxifying toxic metals. However, the regulatory mechanisms governing the response of organic acids to Mn toxicity remain largely elusive, particularly in perennial fruit crops. Herein, we investigated the physio-biochemical and transcriptomic responses of peach seedlings to Mn toxicity. Organic acids, especially malate, significantly increased in Mn-treated peach seedlings. Subsequently, malate application markedly mitigated Mn toxicity in peach. Further, we identified a key vacuolar malate transporter, PpTDT, whose expression was dramatically induced by both Mn and malate treatments. PpTDT was localised to the vacuolar membrane. Heterologous expression of PpTDT in yeast restored growth arrest and enhanced Mn tolerance. Overexpression of PpTDT in tobacco, peach leaves and roots enhanced Mn toxicity tolerance, and increased malate and Mn content. Conversely, silencing of PpTDT in peach seedlings exacerbated Mn toxicity, resulting in decreased malate and Mn content. These findings unveil the role of PpTDT in facilitating intracellular chelation of Mn through malate transport, thereby imparting Mn toxicity tolerance in peach. Our study also highlights the potential of malate as an natural compound for improving Mn toxicity tolerance in peach and potentially other fruit crops.

Population Parameters of the Stinging Catfish, Heteropneustes fossilis in a Semi-Enclosed Wetland Ecosystem: An Insight from the Arial Beel, Bangladesh

Author: Md. Foysul Hossain, Antara Ghosh & Jakir Hossain

Year: 2025

Abstract: Population parameters offer a comprehensive understanding of the population dynamics of fish species within their habitats. This study is the first of its kind to investigate multi-model biological parameters of Heteropneustes fossilis in a semi-enclosed freshwater wetland, specifically the Arial Beel in Bangladesh. The total length and body weight of the specimens ranged from 6.6 to 32.4cm and from 1.1 to 144g, respectively, with the recorded maximum total length representing a new record for H. fossilis in Bangladesh. The b value of the length–weight relationship was 2.93, indicating a negative allometric growth pattern, supported by a high coefficient of determination ($r^2 = 0.98$). Key growth parameters were estimated as follows: asymptotic length ($L\infty$) = 33.93 cm, growth coefficient (K) = 0.34 $year^{-1}$, growth performance index (Ø′) = 2.59, and longevity (t_{max}) = 8.88 years. The form factor ($a_{3.0}$) was calculated at 0.005. The size at sexual maturity (L_m) and optimum catchable length (L_{opt}) for the combined sexes of H. fossilis were 18.38cm and 22.44cm, respectively. The average relative condition factor (K_r) was 1.01, suggesting that the population is in good health within the beel environment. This study provides detailed insights into the growth and biological status of H. fossilis in an interconnected riverine and floodplain wetland ecosystem. Further research incorporating more samples and additional species is recommended to develop a comprehensive ecological profile of Arial Beel, with the aim of establishing it as a model wetland ecosystem for the sustainable management of freshwater resources.

Rethinking household food security under a changing climate in drought prone areas of Ethiopia

Author: Asma Akter

Year: 2025

Abstract: Climate-Smart Agriculture (CSA) is a strategic approach that can mitigate the impacts of climate change on food and nutrition security (FNS). Despite extensive research on this intersection, CSA adoption is often treated as a single, aggregate variable, which may obscure nuanced realities and choices that farmers confront. Additionally, empirical evidence linking CSA adoption to FNS remains limited in drought-prone areas, which face unique challenges such as degraded soils. This study addresses these gaps by using cross-sectional data from 909 farmers in Ethiopia to examine the factors influencing CSA adoption and its impact on FNS, while controlling for placement endogeneity. Applying multivariate probit and endogenous switching regression (ESR) models, we account for selection bias and endogenous covariates. Results show that 84 % of sampled households adopt at least one CSA practice, and CSA adopters generally exhibit higher household dietary diversity scores than non-adopters. Specifically, households implementing soil fertility practices consume an average of four additional food groups daily, while those adopting combinations of yield-boosting and soil fertility practices or yield-boosting and soil erosion control practices consume approximately three additional food groups. In a similar trend, households adopting both soil fertility and erosion control practices have a moderately enhanced diet, consuming two more food groups than their counterparts. Notably, increased crop income emerges as the compelling pathway linking CSA adoption with improved FNS outcomes. In light of the challenges posed by degraded soils and recurrent food insecurity in drought-prone areas, this study underscores the need to support CSA adoption

through enhanced access to information, training, infrastructure, and credit, fostering more resilient agricultural systems and sustainable land use.

Algae-based bioremediation of soil, water, and air: a solution to polluted environment

Author: Mirza Hasanuzzaman

Year: 2025

Abstract: The increasing prevalence of environmental pollutants including both organic and inorganic contaminants in ecosystems is largely due to inappropriate waste disposal. Persistent pollutants, such as heavy metals, plactic debris and industrial chemicals are frequently found in effluents, present a significant concern for Living organisms. Among various waste removal practices, bioremediation is one of the economical and environmentally friendly approaches. The bioremediation process biologically mediates Changes in these pollutants, with microbial communities and microalgae playing a key role in eliminating various types of pollutants in wastewater. Due to its non-degradable nature, plastic contributes to the greenhouse gas emission and significantly impacts climate Change. However, the natural formation of biofilms can degrade the structure of plastic sheets and aid in decomposing bits of plastic in aquatic environments. Furthermore, forming reactive oxygen species in response to antioxidants plays a crucial role in providing tolerance against heavy metal stress in eukaryotic algae. This study investigates the bioremediation potential of microalgae with a focus on its effectiveness in addressing heavy metal pollution, contributing valuable insights to our understanding of the environmental repercussions of these pollutants. The synthesis of algal nanoparticles presents a green and sustainable approach with high adsorptive efficiency. Some microalgae have unique capabilities to consume inorganic nitrogen and phosphorus, which enables them to degrade the pollutants effectively. Algae are responsible for 50% of carbon dioxide fixation through photosynthesis, producing oxygen in the process. This review highlights the cost-effective potential of algae and algal nanoparticles in the bioremediation of soil, water, and air.

Chapter three - Advancement in genome sequencing of wheat wild relatives

Author: Md. Harun-Ur-Rashid

Year: 2025

Abstract: Wheat (Triticum aestivum L.), a domesticated cereal grain, is among the most popular and widely used crops. It has been domesticated by humans for thousands of years. A number of wild relatives of wheat are still growing in various regions around the world. Comprehensive genomic information from these wheat wild relatives may aid attempts to boost wheat productivity by determining the best allele combinations to generate superior cultivars under ever-changing climatic conditions. The technique of determining an organism's entire genome's DNA sequence at once is known as genome sequencing. Genome sequencing provides a wealth of information about plant genetic makeup, gene discovery, comparative genomics, marker development, and molecular breeding, ultimately enabling targeted and efficient crop improvement and agricultural research. The field of genome sequencing began with the advent of Sanger sequencing. Other methods of first generation of genome sequencing are whole-genome shotgun sequencing and clone-by-clone sequencing. Next-generation sequencing technologies, such as Illumina, Oxford Nanopore Technologies, Pacific Biosciences, etc., have changed the field of genomics and brought about significant advancements in various areas of research and applications. These approaches offer options to concentrate on particular genomic regions of interest within the genome while

still considering factors such as genome size and available resources. The headway in genome sequencing technologies has driven the distinguishing proof of various wheat wild relatives with one-of-a-kind genetic traits, and understanding the genetic makeup of these species can help in their preservation and utilization in wheat breeding programs. Moreover, genome sequencing has been instrumental in opening the genetic potential of wild relatives of wheat, empowering us to work with them more successfully to progress the productivity, sustainability, and flexibility of wheat crops, contributing to worldwide food security.

Salinity-responsive hyperaccumulation of flavonoids in Spirodela polyrrhiza, resultant maneuvering in the structure and antimicrobial as well as azo dye decontamination profile of biofabricated zinc oxide nanoentities.

Author: Mirza Hasanuzzaman

Year: 2024

Abstract: Duckweeds (Spirodela polyrrhiza) are free-floating macrophytes that grow profusely in nutrient-rich waters. Under ideal conditions, they exhibit a rapid growth rate and can absorb a substantial amount of nutrients, macromolecules, and pollutants from bodies of water. Zinc oxide nanoparticles (ZnO NPs) synthesized from plant extracts, particularly under stress conditions, have opened new research avenues in the field of nanotechnology. Under salinity stress, the accumulation of flavonoids in duckweeds can affect the structure of ZnO NPs, helping researchers ascertain their antimicrobial role. In our study, we exposed mid-log phase duckweed monocultures to 75 mM NaCl in a full-strength Murashige and Skoog medium for 7 days, followed by a 15-day recovery period. We observed significant overexpression of superoxide and hydrogen peroxide as reactive oxygen species. As a result, chlorophyll and certain metabolites were produced in lesser amounts, while flavonoid and phenol content increased by 12% and 8%, respectively. This overproduction persisted up to 10 days into the recovery treatment period but dropped by 8% and 5%, respectively, by the 15th day. The flavonoid coating transformed the NPs into rosette clusters, which exhibited reduced antimicrobial activity against Aeromonas hydrophila, a Gram-negative, fish-pathogenic bacterium. Herein, we discuss potential mechanisms for the conformational transformation of ZnO NPs into finer dimensions in response to NaCl-induced oxidative stress in duckweed. In this study, the azo dye degradation capacity of salinity-treated plants increased as the flavonoid profile became enriched. Zinc oxide nanoparticles, both prior to and after salinity treatment, were found to be efficient in scavenging azo dye and mitigating its toxicity, as evidenced by improved germination, growth, and overall plant morphometry.

Modulating reactive oxygen species and ion homeostasis for combined salt and cadmium stress tolerance in Brassica campestris: The role of beneficial microbes

Author: Mirza Hasanuzzaman

Year: 2024

Abstract: The land areas and crop species adversely impacted by salinity and heavy metals are growing rapidly. Current research indicates that plant growth-promoting microorganisms offer an environmentally friendly option for improving physiological and biochemical processes in plants growing under stress conditions. The aim of the present study was to investigate the potential mitigation of simultaneous salinity

and cadmium (Cd) stress in rapeseed (*Brassica campestris* cv. BARI Sarisha-17) by the application of *Azospirillum* sp. (Az), phosphate solubilizing bacteria (PSB), potassium mobilizing bacteria (KMB), and vesicular arbuscular mycorrhiza (VAM). Seeds were treated with PSB or KMB prior to sowing, whereas Az, PSB, KMB, or VAM were added as supplements during soil preparation. At 21 days after sowing, the plants were treated with a combination of salt (100 mM NaCl) and Cd (0.25 mM $CdCl_2$), with several applications at 7-day intervals. The combination of salt and Cd stress decreased plant growth and biomass, relative water content, and photosynthetic pigment levels, while also increased electrolyte leakage, lipid peroxidation, and the generation of excess reactive oxygen species (ROS). Salt and Cd stress also impaired plant ion balances of sodium, potassium and nitrate, antioxidant defenses, and glyoxalase system activity. Application of Az, PSB, or KMB restored these parameters to unstressed levels by facilitating the scavenging of ROS, maintaining water status, restoring ion balances, enhancing plant antioxidant defenses, and increasing glyoxalase enzyme activity, while reducing methylglyoxal toxicity and improving photosynthetic activity. The application of KMB was the most effective; however, all microbe supplementations showed the ability to alleviate the damage caused by stress in rapeseed. These findings highlight the ability of soil microorganisms with plant growth-promoting properties to improve the physiological and biochemical functions of rapeseed under Cd and salt stress.

Detailed characterization of the complete mitochondrial genome of the oceanic whitetip shark Carcharhinus longimanus (Poey, 1861)

Author: Sadia A. Kamal

Year: 2024

Abstract: The oceanic whitetip shark Carcharhinus longimanus (family Carcharhinidae) is one of the largest sharks inhabiting all tropical and subtropical oceanic regions. Due to their life history traits and mortality attributed to pelagic longline fishing practices, this species is experiencing substantial population decline. Currently, C. longimanus is considered by the IUCN Red List of Threatened Species as “vulnerable” throughout its range and “critically endangered” in the western north Atlantic. This study sequences and describes the complete mitochondrial genome of C. longimanus in detail.

Copper stress in rice: Perception, signaling, bioremediation and future prospects

Author: Debu Kumar Bhattacharjya

Year: 2024

Abstract: Copper (Cu) is an indispensable micronutrient for plants, animals, and microorganisms and plays a vital role in different physiological processes. However, excessive Cu accumulation in agricultural soil, often through anthropogenic action, poses a potential risk to plant health and crop productivity. This review article provided a comprehensive overview of the available information regarding Cu dynamics in agricultural soils, major sources of Cu contamination, factors influencing its mobility and bioavailability, and mechanisms of Cu uptake and translocation in rice plants. This review examined the impact of Cu toxicity on the germination, growth, and photosynthesis of rice plants. It also highlighted molecular mechanisms underlying Cu stress signaling and the plant defense strategy, involving chelation, compartmentalization, and antioxidant responses. This review also identified significant areas that need further research, such as Cu uptake mechanism in rice, Cu signaling process, and the assessment of Cu-polluted paddy soil and rice toxicity under diverse environmental conditions. The development of rice

varieties with reduced Cu accumulation through comprehensive breeding programs is also necessary. Regulatory measures, fungicide management, plant selection, soil and environmental investigation are recommended to prevent Cu buildup in agricultural lands to achieve sustainable agricultural goals.

Scientific note: First report of small hive beetle in South Asia and their potential invasive pathway

Author: Mohammed Sakhawat Hossain, Muhammad Abdul Hannan & Mst. Munjuri Akter

Year: 2024

Abstract: Aethina tumida Murray, also known as the Small Hive Beetle (SHB), is a well-known invasive kleptoparasite of honeybees (Hood 2004; Papach et al. 2023). Native to the sub-Saharan region of Africa, SHB has spread globally, including the other African regions (Mauritius, Reunion), the Americas (Canada, USA, Mexico, Jamaica, Cuba, Guatemala, El Salvador, Nicaragua, Brazil, Costa Rica, Colombia), Europe (Italy), Asia (China, South Korea, Philippines), and Australia (see Papach et al. 2023). While considered a minor pest in its native range, SHB more frequently causes significant damage to apiaries in invaded regions (Hood 2004; Roth et al 2022). Predominantly parasitic on European honeybees, Apis mellifera (Hood 2004; Roth et al 2022), its impact on the Eastern honeybee, Apis cerana, was unclear until recent verifications in the Philippines (Cervancia et al. 2016) and China (Zhao et al. 2020), with no recorded impact on A. cerana in South Korea (Lee et al. 2017).

Unraveling the mechanisms of biochar and steel slag in alleviating lithium stress in tomato (Solanum lycopersicum L.) plants via modulation of antioxidant defense and methylglyoxal detoxification pathways

Author: Mirza Hasanuzzaman

Year: 2024

Abstract: With progress in technology, soaring demand for lithium (Li) has led to its release into the environment. This study demonstrated the mitigation of the adverse effects of Li stress on tomato (Solanum lycopersicum L.) by the application of waste materials, namely coconut shell biochar (CBC) and steel slag (SS). To explore the impact of Li treatment on tomato plants different morphological, biochemical parameters and plant defense system were analyzed. Tomato plants exposed to Li had shorter roots and shoots, lower biomass and relative water contents, and showed decreases in physiological variables, as well as increases in electrolyte leakage and lipid peroxidation. However, the application of CBC and SS as passivators, either singly or in combination, increased growth variables of tomato and relieved Li-induced oxidative stress responses. The combined CBC and SS amendments reduced Li accumulation 82 and 90% in tomato roots and shoots, respectively, thereby minimizing the negative impacts of Li. Antioxidant enzymes SOD, CAT, APX and GR reflected 4, 5, 30, and 52% and glyoxalase enzymes I and II 7 and 250% enhancement in presence of both CBC and SS in Li treated soil, with a concurrent decrease in methylglyoxal content. Lithium treatment triggered oxidative stress, increased enzymatic and non-enzymatic antioxidant levels, and induced the synthesis of thiols and phytochelatins in roots and shoots. Hence, co-amendment with CBC and SS protected tomato plants from Li-induced oxidative damage by increasing antioxidant defenses and glyoxalase system activity. Both CBC, generated from agricultural waste, and SS, an industrial waste, are environmentally benign, safe, economical, and non-hazardous materials that can be easily applied

on a large scale for crop production in Li-polluted soils. The present findings highlight the novel reutilization of waste materials as renewable assets to overcome soil Li problems and emphasize the conversion of waste into wealth and its potential for practical applications.

Biochar for the Mitigation of Metal/Metalloid Stress in Plants

Author: Mirza Hasanuzzaman

Year: 2024

Abstract: Metal(loid) pollution has become one of the most pressing environmental issues, threatening all living organisms. Metal(loid) stress adversely impacts plant growth, physiology, and overall productivity. Numerous physicochemical approaches have been developed and employed to counteract and reduce the detrimental effects of metal(loid)s. However, these methods have raised environmental concerns, leading to questions about their appropriateness and efficacy. Consequently, alternative and eco-friendly solutions, such as the application of biochar, have gained prominence. Biochar is a carbon-rich material derived from the pyrolysis and hydrothermal processes of various organic materials. Due to its exceptional physicochemi cal properties, biochar is believed to enhance soil quality and fertility. Several global studies have underscored the positive role of biochar in reducing the uptake of metal(loid)s by plants in polluted soils. In this article, we explore various facets of plant reactions to metal(loid)s toxicity and attempt to draw links between biochar use and improvements in plant physiol ogy and performance. We also review the effectiveness of biochar in phytoremediation, its influence on nutrient adsorption mechanisms, and its role in assisting plant growth and defense systems.

Silver nanoparticles in plant health: Physiological response to phytotoxicity and oxidative stress

Author: Mirza Hasanuzzaman

Year: 2024

Abstract: Silver nanoparticles (AgNPs) have gained significant attention in various fields due to their unique properties, but their release into the environment has raised concerns about their environmental and biological impacts. Silver nanoparticles can enter plants following their exposure to roots or via stomata following foliar exposure. Upon penetrating the plant cells, AgNPs interact with cellular components and alter physiological and biochemical processes. One of the key concerns associated with plant exposure to AgNPs is the potential of these materials to induce oxidative stress. Silver nanoparticles can also suppress plant growth and development by disrupting essential plant physiological processes, such as photosynthesis, nutrient uptake, water transport, and hormonal regulation. In crop plants, these disruptions may, in turn, affect the productivity and quality of the harvested components and therefore represent a potential threat to agricultural productivity and ecosystem stability. Understanding the phytotoxic effects of AgNPs is crucial for assessing their environmental implications and guiding the development of safe nanomaterials. By delving into the phytotoxic effects of AgNPs, this review contributes to the existing knowledge regarding their environmental risks and promotes the advancement of sustainable nanotechnological practices.

River pattern influences the composition of small indigenous species (SIS) of fish in deltaic Rajbari district, Bangladesh

Author: Kazi Ahsan Habib

Year: 2024

Abstract: Bangladesh is endowed with diverse rivers providing huge ecosystem services, but the diversity status and the abundance of the small indigenous species (SIS) are not identical in all rivers due to the natural water flow regime and anthropogenic challenges. Therefore, the present study endeavors to elucidate the composition and conservation status of SIS fish from four rivers namely, the Padma, the Gorai, the Chandana and the Horai rivers of Rajbari District, Bangladesh. Data were meticulously collected through fish sampling in each season, field observations, focus group discussions, and individual interviews by using a semi-structured questionnaire spanning from May 2021 and April 2022. The number of SIS in the Padma, the Gorai, the Chandana and the Horai rivers of Rajbari were 60, 36, 33 and 26, respectively, whereas a predominant concentration of fishes was notably observed in the benthopelagic zone of these rivers. Among the 60 riverine SIS, 23 fish were common in the four rivers. Additionally, Cyprinidae (>30%) was observed to be the most abundant SIS in the studied rivers. The fishermen in the research area used seven major fishing equipment of which cast nets are the most common for catching fish species. The abundance of SIS during the rainy season was the highest for all the studied rivers than the other seasons and 12 SIS were available throughout the year. Notably, the least concerned SIS outnumbered the other categories whereas, more than 10% was under the vulnerable category in the four rivers. The leading threats to the fish diversity were pollution followed by illegal and overfishing, siltation, reduced depth, degeneration of rivers and others. Consequently, to safeguard the existing SIS, reducing human pressure, implementing fishing regulations strictly, establishing and administering fish sanctuaries, and raising public awareness can be helpful for the sustainability of aquatic resources in deltaic areas.

Exploring market-based wildlife trade dynamics in Bangladesh

Author: Delower Hossain

Year: 2024

Abstract: Wildlife markets are hotspots for illegal wildlife trade, with traders operating as a result of weak monitoring and law enforcement. Knowledge of species traded, sources, and routes used for transport is needed to identify illegal wildlife trade markets and intervene to stem trade. We conducted surveys in 13 wildlife markets across Bangladesh every month during January-December 2019 to assess the abundance and diversity of wildlife taxa traded and the factors driving this trade. Passeriformes, Columbiformes, Psittaciformes, Artiodactyla, Carnivora and Testudines were the most traded orders. Wildlife markets were also centres of trade for high-value species, including the tiger Panthera tigris, crocodile Crocodylus porosus and tortoises. In hill markets and peri-urban markets the most commonly sold species originated from nearby forests, whereas urban markets included both native species and exotic species sourced internationally. Market type, road links to the market, the presence of law enforcement agencies, proximity to a port and form of sale (live animals or byproducts) all significantly influenced what is being traded. Trade of mammals, reptiles, high-value wildlife species and threatened species was less common in markets proximal to law enforcement agencies. Markets close to seaports or airports were more likely to sell mammals, threatened species and high-value wildlife. Based on our results, we recommend a set of interventions to help reduce market-based wildlife trade in Bangladesh.

Role of Plants in Fluorides and Fluorocarbons Toxicity Remediation

Author: Sheikh Muhammad Masum, Tanvir Ahmad Sourav, A. S. M. Fazle Bari & Saifullah Omar Nasif

Year: 2024

Abstract: Fluorine and fluorocarbons, emitted from natural and human-made sources like brick kilns, industrial manufacturing, and agricultural production, are found throughout the natural environment. The overabundance of fluorine and fluorocarbons, which pose a significant threat to various forms of life, including plants, through soil and water pollution and disruption of soil composition, is a cause for concern. The accumulation of this substance in plants has the potential to significantly impede their growth and development while also presenting a substantial threat to human health. This chapter highlights the crucial role of plants in effectively removing fluoride and fluorocarbons from polluted environments through phytoremediation. By studying how various plant species absorb, translocate, and detoxify these pollutants, we elucidate the potential of phytoremediation as a sustainable and eco-friendly approach to mitigate fluoride and fluorocarbon pollution. Through a comprehensive review of recent research findings, this chapter highlights the effectiveness of different plant species in the remediation process, emphasizing their suitability for diverse environmental conditions. The synergistic effects of plant–microbe interactions and the implications for ecosystem health are discussed. Overall, this study underscores the significance of harnessing the natural capabilities of plants in addressing pressing environmental challenges posed by fluoride and fluorocarbon contamination.

Concentration and Ecological Risk of Heavy Metals in River Sediments of a Developing Country: A Meta-Analysis

Author: Marjana Yeasmin

Year: 2024

Abstract: Heavy metals (HMs) contamination in sediment presents a straightforward issue, particularly noticeable in developing nations. Addressing this problem requires an extensive inquiry into the present situation and potential remedies to keep safe environment. This document compiles statistical procedures concerning various heavy metals such as chromium (Cr), nickel (Ni), copper (Cu), cadmium (Cd), lead (Pb), and arsenic (As) that are available in sediments from Bangladesh spanning the years from 1998 to 2021. The average levels of Ni, Cu, Cd, Pb, and As in sediments of the available data exceeded the corresponding background values, upper continental crust values, and toxicity reference values, indicating severe contamination of sediment by heavy metals. Metal concentrations (Cr, Ni, Cu, and As) generally remained lower than the average shale values, except for Cd and Pb. By utilizing the Pearson correlation coefficient (CCA) and principal component analysis (PCA), it was evidenced that human activities, apart from natural ecological factors, stand as the primary sources of heavy metal pollution in sediment from Bangladeshi waterways. Cd emerged as the key contributor to heightened contamination levels in riverine sediments, as indicated by pollution indices, signifying an ecological hazard. Overall, the data underscored the significant ecological risk posed by the considered hazardous metals. To mitigate sediment heavy metal levels, strategies such as reducing heavy metal discharges at their origins and implementing phytoremediation techniques in sediment, along with improving effluent treatment facilities, could aid in alleviating the issue.