Sher-e-Bangla Agricultural University

SDG Activity Report
on

SDG 12:
Responsible Consumption and Production

Contents

Optimizing growth, yield, and nutritional quality of Chinese cabbage through vermicompost and reduced fertilizer application in organic farming systems

Author: Nishat Islam, Minhazul Kashem Chowdhury, Soumitro Biswas, Jasim Uddain

Year: 2024

Abstract:
Chinese cabbage, though less prominent in Bangladesh, has shown potential for successful cultivation in the region. This study aimed to assess various cultivars' efficacy on Chinese cabbage growth, yield, and quality within an organic farming system. A field experiment was conducted for two consecutive years, investigating the combined impact of cultivar and vermicompost with reduced fertilizer levels on yield. Three cultivars, viz., BARI Chinakopi 1, Blues, and Retasi, were tested along with four fertilizer levels: recommended NPK (control); 80% NPK + vermicompost 6 t/ha; 70% NPK + vermicompost 8 t/ha; and 50% NPK + vermicompost 10 t/ha. Results demonstrated that cv. Blues, treated with 50% NPK + 10 t/ha of vermicompost, exhibited significant enhancements in various parameters compared to the control group. Notably, the treated variety Blues showcased increased plant height (43%), head diameter (46.3%), dry matter (71.2%), and gross yield (72.2%) at harvest. Moreover, var. Blues treated with vermicompost at 10 t/ha displayed elevated levels of vitamin C (28%), β-carotene (96.3%), Ca (7.1%), Mg (18.4%), P (5%), K (10.5%), Fe (13.1%), and Zn (21%) compared to control. These findings suggest that utilizing 50% NPK + vermicompost at 10 t/ha significantly enhances Chinese cabbage growth and quality, particularly in cv. Blues. Incorporating this treatment method could effectively elevate both production yield and crop quality, providing valuable insights for organic farming practices.

Thermochemical and physical characterization of agricultural biomass for sustainable energy in Bangladesh

Author: Debu Kumar Bhattacharjya

Year: 2024

Abstract:
The United Nations Sustainable Development Goals (SDGs) prioritize affordable, clean energy solutions to tackle global issues like poverty, climate change, and environmental degradation. In Bangladesh, agricultural biomass residues present a renewable and underutilized alternative to fossil fuels. This study systematically characterizes the thermochemical and physical properties of key agricultural residues—rice husk, rice straw, wheat straw, sugarcane bagasse, jute stick, dhaincha, and water hyacinth—to assess their potential for sustainable energy production. Key analyses include higher heating value (HHV), proximate composition (volatile matter, fixed carbon, ash), and elemental makeup. Volatile matter content ranged from 71.52 % in rice husk to

90.83 % in sugarcane bagasse, while fixed carbon varied between 7.00 % in sugarcane bagasse and 16.45 % in dhaincha. Ash content was highest in rice straw (15.05 %) and lowest in sugarcane bagasse (2.17 %). The HHV ranged from 19.65 MJ/kg for dahincha to 11.95 MJ/kg for water hyacinth, highlighting dahincha's high energy potential. However, elevated potassium in rice straw (1.62 %) and water hyacinth (2.84 %) suggests risks of slagging in thermal conversion systems. These findings underscore the value of region-specific biomass data in informing energy policy and advancing renewable energy initiatives. By identifying high-potential feedstocks and conversion needs, this study supports targeted biomass applications, contributing to cleaner energy solutions and reduced dependency on fossil fuels. Advanced conversion technologies and ash management strategies are recommended to optimize the energy efficiency of these residues, particularly in regions with abundant agricultural waste. The insights provided serve as a foundation for sustainable biomass utilization in Bangladesh, with potential replicability in other agrarian countries facing similar energy and environmental challenges.

Biochar Outperforms Biochar-Compost Mix in Stimulating Ecophysiological Responses and Enhancing Soil Fertility under Drought Conditions

Author: Mirza Hasanuzzaman

Year:2024

Abstract:
Purpose Biochar (BC) can directly enhance soil fertility, thereby improving land productivity and crop health and restoring degraded lands. This study aims to investigate the potential of BC, alone or combined with compost, to improve soil proper ties and plant drought tolerance, promoting sustainable agriculture amidst climatic and anthropogenic challenges. Methods Phragmites karka was cultivated in a controlled greenhouse with treatments: (i) 0% BC [control, well-watered, 65% water holding capacity (WHC)], (ii) 0% BC (drought), (iii) 1.5% BC (drought), and (iv) 1.5% BC + 1.5% compost (drought). Plant growth, water relations, mineral content, carbon and nitrogen content, proline, soluble sugars, gas exchange, chlorophyll, fluorescence, and soil respiration were measured using standard protocols and advanced instruments. Results Applications of BC or BC + compost improved soil fertility, plant dry biomass, number of tillers, leaf development, and root-to-shoot ratio. Biochar-treated plants showed better leaf water and osmotic potential, essential for turgidity and growth. Biochar also increased leaf proline, soluble sugars, and Ca2+, Mg2+, and K+/Na+ ratios, enhancing osmotic adjust ment and nutrient acquisition of plants. Net photosynthesis, carbon metabolism, photochemical efficiency, and electron transport rate were higher with BC under drought, outperforming the BC-compost mix. Both treatments significantly boosted soil respiration, enhancing soil fertility and drought resilience more effectively than unamended soils. Conclusion Our results show that amending soil with 1.5% BC was more effective in improving plant drought tolerance than a mixture of BC and compost for maximum water management, allowing P. karka to grow under water-limited environments

Selenium and its nanoparticles modulate the metabolism of reactive oxygen species and morpho-physiology of wheat (Triticum aestivum L.) to combat oxidative stress under water deficit conditions

Author: Mirza Hasanuzzaman, Md. Rakib Hossain Raihan, Ayesha Siddika, Md. Sarwar Hosen

Year: 2024

Abstract:
Wheat (Triticum aestivum L.) is one of the most important cereal crop species worldwide, but its growth and development are adversely influenced by drought stress. However, the application of trace elements is known to improve plant physiology under water-limited conditions. In this study, the effects of drought stress on wheat plants were investigated, with a focus on potential mitigation by foliar application of selenium nanoparticles (Se(np)) and sodium selenate (Na2SeO4). The experiment was conducted in a net house using a completely randomized design with four replications. The treatments involved three levels of drought stress (mild, moderate, and severe) started at 30 days after sowing (DAS), with foliar sprays of Se(np) and Se (both 25 µM) initiated at 27 DAS and repeated 4 times at 7-day intervals until 55 DAS.

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.farmers, entrepreneurs, and policymakers, thereby contributing to the sustainable development of the emerging seaweed-based blue economy in Bangladesh.

Role of organic amendments in improving the morphophysiology and soil quality of Setaria italica under salinity

Author: Mirza Hasanuzzaman

Year: 2024

Abstract:
Salinity negatively impacts soil fertility by impairing the development and physiological functions of foxtail millet plants. Organic amendments have emerged as a viable solution in the reclamation and management of salinity inflicted soils and improve the performance of crop. In this regard, a pot experiment was carried out to examine the effect of organic amendments (OAs) on soil quality and its influence on the growth and physiology of foxtail millet under saline and non-saline condition. The findings indicated that under salt stress conditions, the levels of proline, hydrogen peroxide (H2O2), and electrolyte leakage (EL) risen, whilst other physiological parameters decrease in foxtail millet. However, the addition of OAs, particularly dhaincha and biochar (BC), has shown a promising salt tolerant amendment among others. Its addition improved the growth performance of salinity-stressed plants, including plant height, fresh and dry biomass, simultaneously decreased sodium ion (Na+) and improved calcium (Ca2+), potassium (K+), and nitrate ion (NO3−). They also increased proline build up by 6–17 %, reduced H2O2 (19–38 %) and malondialdehyde (16–18 %). Furthermore, they elevated the relative water content (RWC) (25 %), chlorophyll content, and reduced EL (29–50 %). Once more, dhaincha and BC enhanced the number of rhizobia, phosphorus-solubilizing bacteria (PSB) and overall bacterial population in the soil. In saline soil, daincha and BC could enhance soil organic matter (628 %), total nitrogen (1630 %), available phosphorus (32–38 %), and exchangeable potassium (54–73 %). A potential strategy for improving setaria italica performance under salt is suggested to be the following order, dhaincha > biochar > vermicompost > duckweed. The study would assist stakeholders in these salinity-prone areas in strategizing the use of OAs to their fallow land for cultivation and agricultural activities.

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.

Does the adoption of homestead gardening increase dietary diversity in climate-vulnerable coastal areas? Evidence from Bangladesh

Author: Md. Sadique Rahman, Mofasser Rahman

Year: 2024

Abstract:
Coastal areas are not conducive to cultivating a variety of crops due to the occurrence of natural disasters. Therefore, homestead gardening has the potential to increase food production and consumption in coastal households, thereby enhancing climate resilience. Adopting homestead gardening as an adaptation measure for climate change can improve food security in climate-vulnerable areas. This study identified factors associated with the adoption of homestead gardening and their impacts on dietary diversity in coastal areas of Bangladesh. A total of 750 coastal households were surveyed. To analyze the data, descriptive statistics, household dietary diversity score, endogenous switching regression model, and propensity score matching method were applied. According to the results, only 14.26% of coastal households adopted homestead gardening. The likelihood of adoption was increased by factors, such as age, spousal education, own cultivable land size, salinity perception, and mobile phone ownership. Results of the endogenous switching regression model indicated that the adopters of homestead gardens had a 13-point greater mean probability of a higher household dietary diversity score than the non-adopters. Results of the propensity score matching also showed a nearly identical finding. A strong extension service that uses modern information technology is required to disseminate homestead gardening technology in coastal areas. Climate change awareness initiatives are recommended to raise households cognizance on the negative effects of climate change, which in turn helps increase the adoption of homestead gardening as an adaptation measure.

Designing and development of agricultural rovers for vegetable harvesting and soil analysis

Author: AFM Jamal Uddin

Year: 2024

Abstract:
To address the growing demand for sustainable agriculture practices, new technologies to boost crop productivity and soil health must be developed. In this research, we propose designing and building an agricultural rover capable of autonomous vegetable harvesting and soil analysis utilizing cutting-edge deep learning algorithms (YOLOv5). The precision and recall score of the model was 0.8518% and 0.7624% respectively. The rover uses robotics, computer vision, and soil sensing technology to perform accurate and efficient agricultural tasks. We go over the rover's hardware and software, as well as the soil analysis system and the tomato ripeness detection system using deep learning models. Field experiments indicate that this agricultural rover is effective and promising for improving crop management and soil monitoring in modern agriculture, hence achieving the UN's SDG 2 Zero Hunger goals.

Carbon dioxide sensitization delays the postharvest ripening and fatty acids composition of Capsicum fruit by regulating ethylene biosynthesis, malic acid and reactive oxygen species metabolism

Author: Mirza Hasanuzzaman

Year: 2024

Abstract:
Present study would be significant in the sustenance of quality characters for postharvest storage of Capsicum fruit with CO2-sensitization in biocompatible manner. The present experiment describes effects of CO2 sensitization on delaying postharvest ripening through physiological attributes in Capsicum fruit. The experiment was conducted with acidified bicarbonate-derived CO2 exposure for 2 h on Capsicum fruit, kept under white light at 25 °C through 7 days postharvest storage. Initially, fruits responded well to CO2 as recorded sustenance of greenness and integrity of fruit coat resolved through scanning electron micrograph. Loss of water and accumulation of total soluble solids were marginally increased on CO2-sensitized fruit as compared to non-sensitized (control) fruit. The ethylene metabolism biosynthetic genes like CaACC synthase, CaACC oxidase were downregulated on CO2-sensitization. Accompanying ethylene metabolism cellular respiration was downregulated on CO2 induction as compared to control through 7 days of storage. Fruit coat photosynthesis decarboxylating reaction by NADP malic enzyme was upregulated to maintain the reduced carbon accumulation as recorded on 7 days of storage under the same condition. CO2-sensitization effectively reduced the lipid peroxides as oxidative stress products on ripening throughout the storage. Anti-oxidation reaction essentially downregulates the ROS-induced damages of biomolecules that otherwise are highly required for food preservation during postharvest storage. Thus, the major finding is that CO2-sensitization maintains a higher

ratio of unsaturated to saturated fatty acids in fruit coat during storage. Tissue-specific downregulation of ROS also maintained the nuclear stability under CO2 exposure. These findings provide basic as well as applied insights for sustaining Capsicum fruit quality with CO2 exposure under postharvest storage.

Economic viability of releasing Bt cotton in Bangladesh: An early insight

Author: Md. Hayder Khan Sujan, Mohammad Mizanul Haque Kazal, Md. Sadique Rahman

Year: 2024

Abstract:
Insect resistant genetically modified Bt cotton (containing a gene of Bacillus thuringiensis) has substantial potentiality of mounting cotton productivity. This study unveils an early insight on the economic viability of Bt cotton in Bangladesh. A total of 248 traditional cotton farmers and 8 Bt cotton experimental fields were surveyed in April 2022 for achieving the objectives. The data were analysed using descriptive statistics. Findings showed that the cost of Bt cotton production was slightly higher than that of conventional cotton. However, Bt cotton yielded a productivity increase of 0.81 t/ha. The cultivation of Bt cotton resulted in a higher net return (USD 2436/ha) compared to conventional cotton (USD 1624/ha). The results further indicated that the use of insecticides and pesticides in Bt cotton was significantly lower compared to traditional cotton, thereby contributing to the preservation of the natural environment. Overall, cultivation of Bt cotton is economically viable and may generate environmental benefits. Steps are warranted to disseminate and expand its cultivation.

Organic Amendments: Enhancing Plant Tolerance to Salinity and Metal Stress for Improved Agricultural Productivity

Author: Prof. Dr. Mirza Hasanuzzaman

Year: 2024

Abstract:
Salinity and metal stress are significant abiotic factors that negatively influence plant growth and development. These factors lead to diminished agricultural yields on a global scale. Organic amendments have emerged as a potential solution for mitigating the adverse effects of salinity and metal stress on plants. When plants experience these stresses, they produce reactive oxygen species, which can impair protein synthesis and damage cellular membranes. Organic amendments, including biochar, vermicompost, green manure, and farmyard manure, have been shown to facilitate soil nitrogen uptake, an essential component for protein synthesis, and enhance various plant processes such as metabolism, protein accumulation, and antioxidant activities. Researchers have observed that the application of organic amendments improves plant stress tolerance, plant growth, and yield. They achieve this by altering the plant's ionic balance, enhancing the photosynthetic machinery, boosting antioxidant systems, and reducing oxidative

damage. The potential of organic amendments to deal effectively with high salinity and metal concentrations in the soil is gaining increased attention and is becoming an increasingly popular practice in the field of agriculture. This review aims to provide insights into methods for treating soils contaminated with salinity and heavy metals by manipulating their bioavailability through the use of various soil amendments.

Unlocking the potential of co-application of steel slag and biochar in mitigation of arsenic-induced oxidative stress by modulating antioxidant and glyoxalase system in Abelmoschus esculentus L.

Author: Mirza Hasanuzzaman

Year: 2024

Abstract:
This study investigates our hypothesis that how effect of arsenic stress on okra (Abelmoschus esculentus L.) can be alleviated through the use of waste materials such as steel slag (SS) and corncob biochar (BC). Different growth variables, biochemical parameters, oxidative stress markers, enzymatic and non-enzymatic antioxidants and glyoxylase enzyme activities were assessed. When okra was exposed to As, there was a noticeable decrease in seedling length, biomass, relative water content, various biochemical attributes, however, electrolyte leakage and lipid peroxidation in okra were enhanced. The supplementation of SS and BC—either individually or in combination—improved the growth parameters and reduced oxidative stress markers. Application of SS and BC also lowered As accumulation in roots and shoots of okra mitigating adverse effects of As exposure. Additionally, the activities of antioxidant and glyoxalase enzyme increased when SS and BC were present, concurrently reducing methylglyoxal content. Arsenic-induced stress led to oxidative damage, an enhancement in both enzymatic and non-enzymatic antioxidants, induced the synthesis of thiol and phytochelatins in roots and shoots. These may play a vital function in alleviating oxidative stress induced by As. Superoxide dismutase, catalase, ascorbate peroxidase, and glutathione reductase activities were significantly enhanced in As-treated plants. These enhancement were further amplified when SS and BC were amended to As-treated okra. Therefore, synergistic application of SS and BC effectively protects okra against oxidative stress induced by As by increasing both antioxidant defense and glyoxalase systems. Both SS, an industrial byproduct, and BC, generated from agricultural waste, are cost-effective, environmentally friendly, safe, and non-toxic materials which can be used for crop production in As contaminated soil.

Influence of Effective Irrigation Water Usage on Carrot Root Productivity and Quality Properties in Soilless Culture

Author: Md. Dulal Sarkar, Sarmin Akter

Year: 2024

Abstract:

The availability of irrigation water is becoming an increasingly significant concern for crop production in urban areas of Southeast Asia, particularly in Bangladesh. To ensure optimal plant growth and development, it is essential to establish precise irrigation scheduling. Therefore, this study examines the effects of limited irrigation usage on the root quality, production, and morphophysiological features of carrots grown under soilless conditions. Irrigation treatments were in intervals of 200 mL 3-day, 250 mL 2-day, 300 mL 3-day, and 350 mL 4-day. Plants were grown on biodegradable substrates, including cocopeat, sawdust, rice husk, and a mixture of all three with 10% wood ash and 40% cow dung following a randomized complete block design (RCBD). Significant differences in root yield and quality of carrots were observed by irrigation water levels and media types. The yield and quality attributes decreased most when they were subjected to reduced watering, accompanied by a decline in morphological traits (plant height, leaf number, root mass, root length, and diameter) and physiological aspects (relative water content, membrane stability index, and chlorophyll content of leaves). Root quality metrics, i.e., brix, vitamin C, sugar content, beta-carotene, and phenolic content, were also influenced by the frequency of irrigation water used. Root yield and irrigation water usage efficiency were highest with the 2-day interval of 250 mL treatment. The growing media, cocopeat, was found to have acceptable levels of water-holding capacity (87.73%), porosity (69.80%), bulk density (0.10 g cm−3), pH (6.73), and EC (0.14 dSm−1), allowing for optimal carrot growth and development. Watering the plants with 250 mL every 2 days was the best irrigation schedule for growing carrots under a cocopeat-based growth medium, ensuring effective carrot root production considering quality and water use efficiency

Influences of Feed Additives for Sustainable Aquaculture Production in Asia: A Review

Author: Jahid Hasan

Year: 2024

Abstract:
Aquaculture is considered as the primary source to increase fish supply in order to ensure food security and effectively address the nutritional needs of the growing population specially in Asian countries. The utilisation of antibiotics in aquafeeds has been extensively employed in aquaculture of Asian region in order to prevent disease and promote growth. But due to various unfavourable consequences and growing acceptance of the benefits of restricted use of antibiotic administration in aquaculture, the necessity to consider alternate options is urgent. In light of this, the development of eco-friendly feed additives, particularly immunostimulants, for disease control and improved health of aquatic animals is gaining popularity in Asia. The utilisation of natural feed additives has the potential to enhance the efficiency of aquaculture production, reduce the need for medicated treatments, minimise waste discharges, and promote sustainability and long-term profitability. Various high-quality feeds, customised for specific needs, are now supplemented with essential feed additives in the Asian aquaculture industry. The recent focus on functional feed additives has led to the incorporation of probiotics, prebiotics, mycotoxin binders, organic acids, phytogenic compounds, and other medicinal herbs. These feed additives not only boost and support the general health of aquatic animals but also increase consumer confidence in farmed fish. The main objective of the present review is to emphasize the significance of functional feed additives in Asian

aquaculture, as they play a vital role in regulating growth, optimising feed utilisation, and enhancing the overall health status of aquatic animals.

Managing Natural Resources Through Innovation: The Importance of Sustainable IoT-Based Models—The Smart Solar Dryer

Author: Md. Masud Rana

Year: 2024

Abstract:
Many developing countries are use traditional methods of fish drying, which might lead to inferior quality products because of unsanitary conditions and environmental concerns. By using IoT and solar energy to create a regulated drying environment, the smart solar dryer solves these problems. By controlling temperature and airflow, an Internet of Things controller maximizes drying process effectiveness and quality. The smart solar dryer is a flexible solution for a range of situations and needs since it can be adjusted to operate at varying scales, from bigger commercial facilities to small-scale artisanal fish drying. According to preliminary findings, fish can successfully have their moisture content reduced by the smart solar dryer, producing dried goods of superior quality. 500 kg of fish must be dried in 30 h in order to lower the moisture content from 88%. Products are of far higher quality in terms of color, flavor, and texture than the traditional ones. According to preliminary results, this recently created environmentally friendly technique may greatly enhance the quality of dried fish while upholding the principles of sustainable energy. The regulated drying environment lowers the possibility of contamination and enhances overall product safety by assisting in the creation of hygienic conditions that meet food safety regulations. With potential uses in the global food processing industries, the smart solar dryer is a viable option for the sustainable manufacturing of dried fish.

Evaluation of growth and nutritional profile of microgreens of different crops under various LEDs light spectrums

Author: Jasim Uddain

Year: 2024

Abstract:
Carefully selecting the appropriate lighting is vital for indoor farming systems to ensure sustainable agriculture and the production of microgreens rich in health-beneficial phytochemicals. This study aimed to investigate the impact of various light spectrums on the growth and nutritional composition of microgreens. The experiment focused on a single factor: five different concentrations of LED lights, specifically White light (L1) at 100%, Red light (L2) at 100%, Blue light (L3) at 100%, Red and Blue light (L4) at a 70:30 ratio, and Red, Green, and Blue light (L5)

at a 70:10:20 ratio. Four microgreen crops were used: Mustard (C1), Lettuce (C2), Radish (C3), and Broccoli (C4). The results showed that the hypocotyl lengths of C1, C2, C3, and C4 were higher under the L4 light treatment (70:30 Red and Blue), measuring 10.53 cm, 8.47 cm, 15.23 cm, and 11.43 cm, respectively. The shorter hypocotyl lengths of 7.67, 5.53, 11.2 and 7.73 cm were observed under the L1 (White light) condition. The greater fresh weights for C1, C2, C3, and C4 (0.1 kg each) and yields (0.115 kg, 0.110 kg, 0.135 kg, and 0.125 kg, respectively) were also obtained under the L4 light condition. The higher SPAD values for C1 (38.2 nm), C2 (16.9 nm), C3 (55.3 nm), and C4 (49.9 nm) were recorded with the L4 light treatment. Additional findings included potassium content for C1 (0.19%), C2 (0.19%), C3 (0.22%), and C4 (0.16%), and antioxidant capacity for C1 (0.22%), C2 (0.23%), C3 (0.19%), and C4 (0.18%). The higher gross income was achieved with the L4C1, L4C2, L4C3, and L4C4 treatments, while the lower was with the L1C1, L1C2, L1C3, and L1C4 treatments. The benefit-cost ratios were higher (4.1, 3.9, 4.9, and 4.5) for the L4C1, L4C2, L4C3, and L4C4 treatments, respectively. Therefore, a 70:30 Red and Blue light combination (L4) can be used profitably in indoor farming to maximize growth, yield, and nutritional content of microgreens.

Microplastics in sediment and surface water from an island ecosystem in Bay of Bengal

Author: Mir Mohammad Ali

Year: 2024

Abstract:
Microplastics (MPs) have garnered global attention as emerging pollutants in aquatic and terrestrial ecosystems. Despite their significance, studies on MP pollution have overlooked a biodiverse island ecosystem in the northeast Bay of Bengal. Hence, the current study is a pioneering effort to delve into this issue with the island. This research embodies the first comprehensive report exploring the presence of MP pollution in sediment and surface water and their influencing factors along Sandwip island in the northeast Bay of Bengal. The average MP concentration was 305 ± 37.16 (items/kg) in sediment and 106.14 ± 22.57 (items/m3) in surface water. Fragments emerged as the predominant type in sediment (78.77%) and surface water (54.64%) samples. Fourier Transform Infrared Spectroscopy identified three plastic polymers, the most abundant being polyethylene (56%) and polypropylene (41%). Anthropogenic activities, particularly fishing practices, improper waste disposal, and inadequate waste management strategies, were pinpointed as potential sources of MP contamination on the island. MP concentrations in water and sediment correlated positively with pH and organic matter ($p < 0.000$), indicating important factors influencing MP distribution. The spatial distribution and hotspots of MPs followed significant human routes. By shedding light on the extent of MPs' presence and their potential sources, this study contributes essential insights that can inform effective environmental management strategies for the island's future well-being.

Assessment of As, Cr, Cd, and Pb in urban surface water from a subtropical river: contamination, sources, and human health risk

Author: Mir Mohammad Ali

Year: 2024

Abstract:
This work aimed to determine the level of some toxic elements (As, Cr, Cd, and Pb) in the water of the Rupsha River, Bangladesh, concerning their potential dangers to human exposure. The elemental concentrations (mg/L) were determined using Atomic Absorption Spectrometer and found to decrease in the order of Cr (0.041) > Pb (0.029) > As (0.004) > Cd (0.002). The level of elements in this river water surpasses various international limits, making it unfit for human consumption. Furthermore, the metal pollution index and contamination index indicated that the water was also unsuitable for this purpose. The elements chosen were persuasive to discern the hazard quotient of non-carcinogenic risk. Moreover, total targeted hazard quotient (TTHQ) values were found for adults and children within acceptable limits (TTHQ <1). The value of carcinogenic risk did not surpass the range (10−6 to 10−4) of the threshold limit. Due to their high-water consumption per unit of body-weight and physiological development, children were found to be more sensitive than adults. Multivariate analyses demonstrated that human activities were the primary origin of toxic elements in river water. According to the findings, urban and industrial effluents should be treated before being released into rivers. Development along the river bank must be carefully controlled to safeguard the river environment. In the end, this will improve the quality of the water and lower the chance that people will be exposed to metals.

Optimizing growth, yield, and nutritional quality of Chinese cabbage through vermicompost and reduced fertilizer application in organic farming systems

Author: Nishat Islam, Minhazul Kashem Chowdhury, Soumitro Biswas, Jasim Uddain

Year: 2024

Abstract:
Chinese cabbage, though less prominent in Bangladesh, has shown potential for successful cultivation in the region. This study aimed to assess various cultivars' efficacy on Chinese cabbage growth, yield, and quality within an organic farming system. A field experiment was conducted for two consecutive years, investigating the combined impact of cultivar and vermicompost with reduced fertilizer levels on yield. Three cultivars, viz., BARI Chinakopi 1, Blues, and Retasi, were tested along with four fertilizer levels: recommended NPK (control); 80% NPK + vermicompost 6 t/ha; 70% NPK + vermicompost 8 t/ha; and 50% NPK + vermicompost 10 t/ha. Results demonstrated that cv. Blues, treated with 50% NPK + 10 t/ha of vermicompost, exhibited significant enhancements in various parameters compared to the control group. Notably, the treated variety Blues showcased increased plant height (43%), head diameter (46.3%), dry matter (71.2%), and gross yield (72.2%) at harvest. Moreover, var. Blues treated with vermicompost at 10 t/ha displayed elevated levels of vitamin C (28%), β-carotene (96.3%), Ca (7.1%), Mg (18.4%),

P (5%), K (10.5%), Fe (13.1%), and Zn (21%) compared to control. These findings suggest that utilizing 50% NPK + vermicompost at 10 t/ha significantly enhances Chinese cabbage growth and quality, particularly in cv. Blues. Incorporating this treatment method could effectively elevate both production yield and crop quality, providing valuable insights for organic farming practices.

Sustainable management of Spodoptera litura (Fab.) in tropical Sugar Beet

Author: Md. Emam Hossain, Md. Shahidul Islam Khan, Ruhul Amin

Year: 2024

Abstract:
Control of Spodoptera litura in the tropical sugar beet is a critical issue for sustainable agriculture. The purpose of this field experiment was to assess the efficacy of botanical and non-chemical techniques against S. litura to identify ecologically viable management alternatives. Spodoptera litura responded best to a neem oil solution at a concentration of 3.0 mL/L. In terms of insect infestation, the plot treated with neem oil outperformed the untreated control plot. The infection rates for plants, leaves, and beets were 5.66/plot, 5.33/plant, and 11.00/plot, respectively. In terms of larvae decrease over control, the plot treated with neem oil had the greatest effectiveness (84.33%), followed by pheromones, which had an efficiency of 80%. Plants treated with neem oil showed the highest Brix and Pol values (17.61% and 12.62%, respectively). Weight per beet was lowest in the control plot (690.33 g), and highest in the best treatment (791.33 g). It clearly shows that when insect infestation grows, beet yield falls. The control plot was unable to effectively resist S. litura, resulting in unhealthy sugar beet output. In contrast, eco-friendly techniques such as NPV spraying, Bio Neem Plus®, Tracer 45SC (spinosad), hand picking, light trap, and polythene mulching trap outperformed the control plot.