



Sher-e-Bangla Agricultural University

SDG Activity Report on

SDG 09: Industry, Innovation and Infrastructure

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Determinants of household adoption of clean energy with its rural–urban disparities in Bangladesh

Author: Iqramul Haq, Maruf Khan, Sharanon Chakma, Md Mizanur Rahman Sarker

Year:2024

Abstract: This study aims to investigate factors influencing the adoption of clean energy among households in Bangladesh, using Blinder-Oaxaca decomposition and extended probit regression model with data from the 2019 Bangladesh multiple indicator cluster survey. Small households, primarily Muslim and urban dwellers, who speak the Bengali language and are Internet and mobile users, were likelier to adopt cleaner fuels than their counterparts. On the contrary, households residing in the Barisal, Khulna, Rajshahi, and Rangpur divisions, belonging to poor and middle-class households, with household heads aged 15–64 and without formal education, were less likely to adopt cleaner fuels than their counterparts. The concentration curve revealed socioeconomic inequality in the adoption of clean energy, particularly favouring richer households in urban and rural areas. Further analysis using the Blinder-Oaxaca decomposition showed that urban residents showed a higher probability of adopting clean energy, with a significant difference of 0.508 compared to rural areas. Regarding the endowment effect, poor wealth quintile contributed the most, followed by the ownership of rented dwellings and the middle wealth quintile. The Bengali differential effect made the largest contribution to this aspect of the disparity, followed by the exposure of the Internet and the influence of the Dhaka and Chattogram divisions. The detailed analysis provides valuable insights for policymakers and practitioners on the issue of disparities in the adoption of clean energy between urban and rural areas in Bangladesh.

Knowledge, attitude, and practice of food safety: a survey on processed potato products manufacturer in Bangladesh

Author: Tuhin Suvra Roy, Maruf Mostofa

Year:2024

Abstract: The main focus of the study was to evaluate the level of knowledge, practices, and policies of potato-based product, manufacturers in Bangladesh regarding food safety and quality issues, particularly acrylamide, a probable human carcinogenic compound formed in potato-based products during heat processing. Among twenty-one processed potato product manufacturers, only fifteen were found interested in participating in this study. A pre-developed questionnaire was used to collect data from the respondents and descriptive statistical measures were used for data analysis. The results revealed that most of the manufacturers are not aware of the Maillard reaction (60%) and acrylamide formation (53.3%) during potato processing. Although the manufacturers are familiar with reducing sugar (80%) and amino acids (73.3%), they were unaware that these are acrylamide precursors that must be quantified before potato processing. Most of the manufacturers (83.3%) prefer 150-200°C temperature for frying and the remaining (16.7%) use above 200°C. However, no manufacturers performed acrylamide analysis as they didn't have any standard policy. Only 16.7% of manufacturers adopted the mitigation strategy for acrylamide reduction. Additionally, almost 58.3% of manufacturers are not aware of the international trade barrier on the export of potato products based on the acrylamide level. There has been a crucial demand for further research on revising and updating the food safety policies and practices during the processing of potatoes to safeguard the health of the consumers by relevant regulatory bodies in Bangladesh for acrylamide to get on with the latest industrial and technological innovations along with skill developing training to remove the trade barrier on export.

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.

Detection and Identification of Honey Pollens by YOLOv7: A Novel Framework toward Honey Authenticity

Author: Islam Md Meftaul

Year:2024

Abstract: Honey, a valuable and globally consumed food product, has significant market potential linked to its origin. However, authenticating honey is challenging due to sophisticated adulteration techniques. This current research introduces an innovative approach employing YOLOv7, a cutting-edge object detection model, to detect and classify honey pollens, thereby bolstering the authentication of honey. Our methodology involved creating a data set comprising three well-known honey varieties (Sundarban, Litchi, and Mustard), supplemented by three sets of unidentified honey pollen images sourced from Kaggle. Subsequently, we assembled a data set consisting of 3000 images representing the pollen types extracted from the known honey samples. To tackle the challenge of limited sample sizes, we employed data augmentation techniques. The efficacy of our approach was evaluated using established statistical measures including detection accuracy, precision, recall, mAP value, and F1 score, yielding impressive values of 98.3, 99.3, 100, 99.2%, and 0.985, respectively. The YOLOv7 model's reliability was validated using Kaggle's unknown honey pollen data sets, which showed that it correctly detected and identified these new pollens based on previous training. Through rigorous experimentation and validation, our study underscores the potential of the YOLOv7 framework in revolutionizing quality control practices within the honey industry, ensuring consumers access to genuine and top-tier honey products through pollen image analysis.

Unlocking high-value products from diatoms via biorefinery processes for a sustainable biocircular economy

Author: Antara Ghosh, Roksana Jahan

Year:2024

Abstract: As a repository of valuable pigments, fatty acids, and proteins, microalgae, particularly diatoms, make promising foundations for bioprospecting of biomedical, nutraceuticals, biofuel, feed, and food. Therefore, they are considered as next generation biomass. The necessity to valorize these biomasses is essential to bolster the economic feasibility of their industrial production through diverse biorefinery processes. The capacity for conducting multiple extractions concurrently offers prospects for obtaining various metabolites, biogas, and biofertilizers from diatom biomass. This unique feature significantly enhances the economic sustainability of diatom-based biorefineries. An effective biorefinery approach is highly desirable as it has the capability to fully capitalize the potential of diatoms. This chapter offers insights into the inherent value of diatoms and outlines the scenario of biorefinery processes aimed at realizing a sustainable biocircular economy. This information could serve as a solid foundation for making well-informed and profitable decisions in the realm of diatom-based bioproducts, thereby contributing to both economic success and sustainability.

Energy potential of biomass from rice husks in bangladesh: An experimental study for thermochemical and physical characterization

Author: Debu Kumar Bhattacharjya

Year:2024

Abstract: Rice husks, abundant leftovers from rice production, offer immense potential as a renewable energy source through thermochemical conversion processes. However, their efficient utilization hinges on understanding their unique thermal properties and reaction kinetics. This study addresses a critical gap by meticulously analyzing four prominent Bangladeshi rice husk varieties: BR22, BRRI Dhan46, BRRI Dhan47, and BRRI Dhan49. Through rigorous experimentation, we unveil a comprehensive dataset encompassing their physical, chemical, and thermochemical characteristics. Our investigation reveals favorable alignment of moisture content with various conversion technologies, alongside suitable bulk density for efficient handling. Proximate analysis sheds light on crucial components like ash, volatile matter, and fixed carbon, vital for optimizing combustion efficiency. Furthermore, elemental analysis not only highlights the presence of ash-forming elements but also assures low nitrogen and sulfur content, suggesting potential environmental benefits compared to conventional fuels. Delving into thermochemical characteristics, we measured higher heating values ranging from 13.31 MJ/kg to 14.42 MJ/kg, confirming the viability of these rice husk varieties for energy conversion. Thermogravimetric and kinetic analyses further illuminate their unique decomposition behavior, with BRRI Dhan47 exhibiting the highest decomposition rate, emphasizing the distinct reactivity profiles of different varieties. This extensive dataset empowers researchers and industry professionals with valuable insights for informed decision-making. By understanding the unique attributes of each rice husk variety and their behavior during conversion, we can optimize operational parameters for various thermochemical methods. Ultimately, this study bridges a critical research gap and paves the way for more efficient and sustainable utilization of rice husks as a renewable energy source, contributing to a greener future.

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

Author: Md. Hayder Khan Sujon, 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.

Site suitability mapping for different seaweed cultivation systems along the coastal and marine waters of Bangladesh: A Generalized Additive Modelling approach for prediction

Author: Afshana Ferdous

Year:2024

Abstract: While seaweed cultivation has reached an advanced stage in many Asian countries, this industry remains nascent in Bangladesh, hindered by a lack of comprehensive site suitability mapping. To address this gap, we employed the Generalized Additive Model (GAM) approach to develop habitat suitability maps for different seaweed cultivation systems encompassing the entire coastal and marine territorial areas of Bangladesh. Our study leveraged an in-situ dataset comprising production and environmental factors from 180 cultivation plots of four species (*Gracilaria* sp., *Enteromorpha intestinalis*, *Ulva lactuca*, and *Hypnea musciformis*) across five cultivation sites, supplementing this data with other ecological variables derived from satellite observations and model simulations. The GAM analysis identified seven key explanatory variables that collectively accounted for 78 %, 76 %, and 79 % of the observed variability in seaweed data for off-bottom long-line, off-bottom net, and floating long-line cultivation systems, respectively. The model predicted that total suspended solids (TSS) predominantly influenced the habitat suitability for off-bottom net and floating long-line cultivation systems, while salinity was a crucial determinant for off-bottom long-line cultivation systems. The study further demonstrated that the predicted suitable areas (50–100 %) for floating long-line cultivation systems (1850 km²) substantially outnumbered those for off-bottom long-line (372 km²) and off-bottom net (380 km²) cultivation systems. The model showed that the southeast coast, specifically the sandy bottom areas of the Moheshkhali channel and its surroundings, exhibited high suitability (>75 % probability) for off-bottom long-line and off-bottom net cultivation systems. In contrast, the floating long-line cultivation system appeared most suitable for seaweed farming along almost the entire coastline of Bangladesh, excluding the Meghna and adjacent estuaries in the central region. Notably, the most suitable areas were specifically concentrated in the coastal areas of Moheshkhali Island, Cox's Bazar, Teknaf, and Saint Martin's Island in the southeast coastal zone, extending potentially to far offshore waters. The predictions of our model aligned well with in-situ observations, as evidenced by an area under the curve (AUC) of 0.83 and an R² value of 0.85. The insights gleaned from this research offer invaluable guidance to seaweed farmers, entrepreneurs, and policymakers, thereby contributing to the sustainable development of the emerging seaweed-based blue economy in Bangladesh.

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.

Role of Plants in Fluorides and Fluorocarbons Toxicity Remediation

Author: Sheikh Muhammad Masum, Tanvir Ahmad Sourav, A. S. M. Fazle Bari, Md. Hasanuzzaman

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.

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.

Clean energy transition in rural Bangladesh: Challenges in adoption and impact

Author: Md. Sadique Rahman, Md. Hayder Khan Sujan

Year:2024

Abstract:

At the household level, the solar photovoltaic (PV) system is an off-grid clean energy source with significant poverty reduction potential, thereby contributing to the attainment of several sustainable development goals. Nevertheless, there has been limited adoption of renewable or clean energy technologies in Bangladesh. At present, renewable energy sources account for only 3% of the country's electricity generation. This study thus investigates the drivers of solar PV adoption and the impact of this on household income and poverty in Bangladesh. We present an econometric analysis of data from the International Food Policy Research Institute's Bangladesh Integrated Household Survey, 2020. Our findings indicate that only 5.51% of the sample households adopted solar PV, with the likelihood of adoption 3.8% higher in households with a mobile phone, 1.7% higher in households with internet access, and 2.8% higher among homeowners. However, the government's programs to expand the electricity grid made the delivery of solar PV by partner organizations less competitive. Our analysis reveals that the adoption of solar PV has a positive effect on household income of between 9.31% and 13.50%. The poverty gap is likely to decrease by around 20% to 26% due to adoption. These findings are pertinent to ongoing policy development efforts targeted at increasing the adoption of renewable energy to meet the sustainable development goals. Solar PV information could be potentially disseminated through mass media and modern communication technologies that require internet access. Furthermore, increasing the installation of solar PV systems in rented houses may promote the adoption of solar PV. It is imperative to implement policies that provide incentives for the installation and utilization of solar PV.

Farmers perspectives on options for and barriers to implementing climate resilient agriculture and implications for climate adaptation policy

Author: Shilpi Kundu

Year:2024

Abstract: The impacts of climate change in low lying coastal areas, such as Bangladesh, are adversely affecting food and livelihood security, requiring adaptation to build resilience. However, effective implementation is limited by a lack of local-level knowledge regarding the barriers that prevent adoption and up-scaling of climate resilient agriculture (CRA). Case studies in coastal Bangladesh provide novel insights regarding barriers to planned and autonomous adaptation from the perspective of farmers facing multiple climate change impacts across seven key dimensions of CRA (agrometeorology services, water management practices, nutrient management activities, technologies and knowledge management activities, infrastructure development, socio-economic resilience, and institutions and good governance). Farmers generally perceive that adaptation actions increase resilience in crop production systems and their surrounding social systems, but also identify the important barriers that inhibit or constrain planned and autonomous adaptation opportunities. Planned adaptation actions are perceived to be limited by institutional

arrangements and lack of implementation capacity. Autonomous adaptation was found to be dependent on income level, farm-holding size, access to input resources and services and peer/social influences. Planned and autonomous adaptation actions were both affected by specific social and geographic contexts and cultural factors. Recommendations are suggested to address key constraints and thereby promote CRA in coastal agricultural landscapes in Bangladesh and in other developing countries confronting similar challenges.