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Devi Dayal

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Influence of whole tubers versus cut potato tubers and planting density on the yield and profitability of Potato (*Solanum tuberosum* L.)

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ABSTRACT: Potato (*Solanum tuberosum* L.) plays a vital role in the livelihood and diet of the people of Meghalaya and contributes approximately 10% of the total potato production in India. However, productivity is hampered due to lack of planting material for improved varieties at reasonable prices and knowledge of improved potato technologies. Potato seeds constitute about 40-50% of the total cost of cultivation which is not affordable by the small and marginal farmers. To address these challenges, a field experiment was conducted at ICAR- CPRI RS Shillong to study the influence of whole seed tubers versus cut seed tubers and planting density on the yield and profitability of Kufri Himalini under rainfed condition. This study included four plant spacing treatments, i.e. S1: 60 x10 cm cut seed tuber, S2: 60x 15 cm cut seed tuber, S3: 60x 20 cm cut seed tuber and S4: 60 x 20 cm whole seed tuber. The study aimed to increase the tuber yield and net returns by reducing the cost of seed tubers. The results showed that the combination of the K.Himalini variety with whole seed tubers planted in 60x20cm spacing (S4) showed superior performance on marketable (19.64 t ha-1), total tuber yield (25.75 t ha-1)and the benefit-cost ratio was2.33. The second highest marketable (16.38 t ha-1) and total tuber yield (22.56 tha-1) and benefit-cost ratio 2.20 was recorded S2 (60 x 15cm) planting of cut tubers of K.Himalini. Therefore, these treatment combinations can increase potato production and improve the smallholder farmers' income and food security in the region and similar agroecological regions.

Key words: Seed potato, whole tuber, cut pieces, yield

Production of *Chlorella* sp. biomass in a flat plate photobioreactor and evaluation of flocculation effectiveness

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ABSTRACT: Buildings are major energy consumers as they account for majority of world's total energy consumption and research has revealed that CO_2 emissions from building sector exceeds those from the industry and transport sectors. Integrating micro algaephoto bioreactors with building facade will convert the building walls into photosynthetic surfaces which will respond to climate changes and convert the walls into energy producing factories. Studies on building facade designs to absorb CO_2 and to decrease the air temperature while preserving the identity and integrity of the building has gained considerable attention. With this as the focus, the present research work uses a 10 l flat plate glass photobioreactor with dimensions of 290 mm x 187 mm x 320 mm for *Chlorella*sp. cultivation. The maximum growth rate was found to be 0.394 per day. A maximum biomass concentration of 56.3 g/l was obtained after seven days of cultivation under 24 h light intensity of 1500 lumen. In addition, the potential of harvesting *Chlorella* sp.biomass by flocculation using chemical and natural flocculant was assessed. It was found that although chemical flocculation occurs rapidly, causing environmental concerns, the bioflocculant along with biomass could be safely used for further processing of the flocculated biomass into biofuels.

Keywords: Microalgae, photo bioreactors, *Chlorella* sp., bioflocculation, Algae facade

Investigations on for surfactant recovery from industrial sulphonation waste

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ABSTRACT: Alpha- olefin sulfonates (AOS) are a class of detergents produced by the sulfonation of alpha- olefins using sulfur trioxide. Post sulfonation, the effluent gas purification results in an acid slurry waste which is dark coloured and highly viscous in nature. The disposal of this waste can be effected by recovering valuable ingredients present in this waste and thereby reducing the environmental pollution. Preliminary experiments were carried out to study the possibilities of either treating the slurry. This work was therefore directed towards a hydrolytic process to treat this waste and then carry out a quantitative determination of the surface active ingredients from this slurry.In order to directly utilise the waste, the recovered mass was tested for its acid value and surfactant activity by using decolourising agents and tested for its use as a low grade surfactant. The parameters affecting the surfactant recovery process were identified and established for providing the maximum yield which was found to be 79%. Fourier transform infrared spectroscopy analysis carried on the recovered residue showed close agreement with that of the standard pure form of the surfactant.

Keywords: Sulphonation, Sultones, Alpha Olefin Sulphonate, Alpha Olefins, Decolourization

Optimizing controlled-environment food factories for sustainable high-density crop production: a low-cost prototype analysis

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ABSTRACT: To feed a projected 9 billion people by 2050, agricultural productivity must increase by 70% while addressing UN Sustainable Development Goals for 2030, specifically responsible land, water, and emissions use. With per capita farmland decreasing by 22% since 2000, traditional farming is unlikely to meet rising food demands. Controlled-environment food factories offer a promising alternative, ensuring consistent yields, enhanced produce quality, and efficient resource use compared to greenhouses and open-field systems. This study presents a cost-effective, four-tier food factory prototype (2.5 m x 2.5 m x 2.5 m), optimized for light, nutrition, and climate control to maximize crop productivity. We evaluated the productivity of this food factory system against traditional soil-based cultivation, using the same cultivation area (6.25 m^2). The food factory accommodated 408 plants, a planting density 10 times greater than the 42 plants possible with field cultivation. Yield from the food factory was 46 kg which is 12 times higher than the 3.8 kg yield in soil-based systems. This indoor system also improved light, nutrient, and water efficiency, demonstrating how controlled environments can effectively use space and boost yields. Economically, the food factory's benefit-cost (B-C) ratio was 2.68, compared to 1.20 for open-field cultivation, indicating higher profitability. The prototype's setup cost was Rs. 1,20,000, with a breakeven period estimated at 1.5 years. Further integration with solar photovoltaic panels could make energy use even more efficient, enhancing the system's sustainability. This low-cost, high-output model demonstrates a scalable solution capable of meeting future food needs while significantly optimizing land and resource use, aligning with

sustainable agricultural goals and offering a resilient approach to food production in the face of global challenges.

Keywords: Controlled-environment agriculture, Food factory, High-density cultivation, Resource efficiency, Sustainable crop production.

Morphometric prioritization and optimization of best management practices for a Mid-Himalayan Watershed Using Multi-Criteria Decision-Making Approaches

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ABSTRACT: Soil erosion significantly affects human activities by reducing soil productivity in the Eastern Nayar watershed of Uttarakhand'sPauri district. Therefore, evaluating erosion-prone areas is essential to implement effective preventive measures. This study assessed the sub-basins within the watershed using morphometric parameters and multi-criteria decision-making models, including Simple Additive Weighting (SAW) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). Morphometric parameters were derived and analyzed using Advanced Space Thermal Emission Radiometer (ASTER) data and a 30 m Digital Elevation Model (DEM). To test the MCDM methods, percent and intensity of change indices were applied. The TOPSIS model categorized erosion risk into four levels—low, moderate, high, and very high—while the SAW model provided three categories: moderate, high, and very high. Overall, the morphometric parameters effectively identified areas prone to erosion, with the TOPSIS approach showing slightly higher predictive accuracy. Additionally, maps were generated to pinpoint suitable rainwater harvesting structures, such as farm ponds, check dams, and percolation tanks, within the watershed.

Keywords: GIS, RWH, MCDM, Remote sensing

Watershed Prioritization through Morphometric and LULC Analysis Using GIS and FAHP Approach

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ABSTRACT: Watershed prioritization is a very important aspect in management of natural resources, especially land and water conservation. For the planning and monitoring process, morphometric analysis and spatial data for LULC are important. Kosi watershed is located in the Kumaun region of Uttarakhand. The watershed spans across 1,819 km². It varies between 363 m and 2,722 m of elevation. The origin of the Kosi River is located in the district of Almora draining through Ramnagar; the river then further joins with the Ramganga River. This watershed is prone to many problems related to soil erosion, stream shifting, and flash floods; thus, this watershed needs emphasis. Some parameters like stream length, drainage density, and others, which were subjected to statistical analysis based on SRTM DEM data showed relationships of erodibility with several factors. The analytical hierarchy process using FAHP is applied to rank nine parameters classifying sub-watersheds in different priority levels. In the LULC analysis, land types were primarily forest and wasteland, and built-up areas were in a lesser number. From the prioritization, this shows that sub-watersheds SW3, SW6, and SW9 ranked very high and would provide insights for effective conservation strategies and thus outlines the importance of remote sensing and GIS in watershed management.

Key words: Watershed prioritization, Morphometric analysis, LULC (Land Use/Land Cover), FAHP (Fuzzy Analytical Hierarchy Process), GIS and remote sensing

ABOUT THE BOOK

This book consists of compilation of abstracts and papers presented in the 5th International Conference on Advancement of Science and Technology for Environment, Society and People (ICASTESP-V), Organised by the Society for Technology, Environment, Science & People, Kozhikode, Kerala during 15-16 November 2024. A number of topics covering natural resource management, crop production, post-harvest handling, farm empowerment and social science were some of the major highlights in the conference.

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