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Contents

Knowledge management in organizing agricultural extension through some organizational processes from the point of view of farm workers in Salah al-Din Governorate

[1] Rana Diaa Hazem AL-Maimary, [2] Majeed Hadi Saleh Al-Hamdany

[1+2] Tikrit University/ College of Agriculture/ Department of Economics and Agricultural Extension, Iraq.

* Corresponding author's email: Dr.majeed@tu.edu.iq.

E-mail addresses of co-authors: Dr.majeed@tu.edu.iq, rh230056pag@st.tu.edu.iq .

Abstract

The study mainly aimed to identify knowledge management in the organization of agricultural extension through some organizational processes from the point of view of farm workers in Salah al-Din Governorate, as well as to determine the significance of the correlation between knowledge management and each of the following studied independent variables (age, gender, educational attainment, length of service, academic specialization, job position). The study community included all employees of Salah al-Din Governorate who were officially registered in the governorate departments, and their number was (400) agricultural employees. A proportional random sample was drawn at a rate of (40%) of the total number of employees in the governorate, with a size of (160) respondents. A preliminary test of the data collection tool was conducted on a random sample of 30 respondents from the community outside the study sample. The apparent validity was verified by presenting the questionnaire form to several agricultural extension specialists to achieve the study objectives. The Cronbach's alpha equation was used to find stability, and its value reached (0.911). Field data was collected through a personal interview during October and November 2024. The scale consisted of (38) paragraphs measuring the level of knowledge management, consisting of five areas: (the process of generating and diagnosing agricultural knowledge, the process of organizing and acquiring agricultural knowledge, the process of storing agricultural

knowledge, the process of developing and sharing agricultural knowledge, and the process of applying agricultural knowledge). The data were unloaded and arranged in tables to analyze them and obtain their implications. The SPSS program was used to analyze the data, and some statistical methods such as ratio, frequencies, arithmetic mean, weighted mean, percentage weight, and variance equations. The results of the study of the level of knowledge management in the agricultural extension organization through some organizational processes from the point of view of agricultural workers in Salah al-Din Governorate showed in general that there is a weakness in knowledge management and that the scores of the respondents ranged between (71-177) degrees, with an arithmetic average of (125.96) degrees. The results of the study recommended the need for the agricultural extension agency to pay attention to the application of agricultural knowledge, and this is done by establishing a division in the agricultural departments concerned with knowledge management and supervision, and at the same time being responsible for providing information and knowledge to extension workers at the appropriate time, and being the reference for all workers in agricultural extension, taking into account facilitating the workers to benefit from the information in a proper smooth manner away from complexity.

Keywords: Knowledge management, agricultural extension, agricultural workers, Salah al-Din Governorate.

Climate Change Mitigation Strategies in the Coastal Region of Bangladesh

Abu Noman Faruq Ahmmed[1], Mehedi Amin[1], Shaikh Fazlul Huque Moni[2]*

[1]Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka-1207

[2]Department of Agricultural Extension (DAE), Ministry of Agriculture, Dhaka, Bangladesh

**Corresponding Author: nomanfaruq@sau.edu.bd*

Abstract

Climate change presents significant challenges to agriculture, freshwater resources, and food security, with coastal regions being particularly vulnerable. In the southwestern coastal area of Bangladesh, frequent tropical cyclones, storm surges, erratic rainfall, water stagnation, and increasing soil salinity have severely affected agricultural productivity. These challenges leave a significant portion of cultivable land fallow during the rabi and kharif seasons, necessitating innovative approaches to sustain agricultural livelihoods. The adoption of climate-smart agricultural practices has emerged as a promising solution in this region. Techniques such as relay cropping, mixed cropping, intercropping, the sorjon method, drip irrigation, and poly-mulch practices have demonstrated their effectiveness in enhancing agricultural production. These approaches emphasize efficient water management, soil health retention, and advanced crop protection strategies, allowing farmers to improve productivity and adapt to changing climatic conditions. By implementing these practices, previously uncultivated lands have been reclaimed, significantly increasing crop acreage and yield. Notably, these efforts transformed single-crop systems into double-crop systems, reclaimed over 2,300 hectares of previously uncultivated land, and provided economic benefits exceeding 280 million BDT. Farmers achieved higher profitability through early crop production and efficient resource utilization. Farmers have also reduced production costs and achieved better profitability through early crop production and efficient resource use. These interventions not only ensure

sustainable food security but also contribute to improved socioeconomic conditions for farming communities in the region. This study shows the potential of climate-smart agriculture as an adaptive strategy to mitigate climate change impacts. It highlights how the integration of innovative techniques can enhance resilience, productivity, and sustainability in climate-affected regions like coastal Bangladesh.

Keywords: Knowledge management, agricultural extension, agricultural workers, Salah al-Din Governorate.

Small Dam Design and Construction for Sustainable Water Resources Management: A Comprehensive Review

Nawbahar Faraj Mustafa [1] * *and Abdalmajeed Mohammed Rahman* [1]
[1] *Water Resources Engineering Department, University of Sulaimani, Kirkuk Road, Sulaymaniyah, 46002, Iraq.*
nawbahar.mustafa@univsul.edu.iq,
https://orcid.org/0000-0001-7585-3698
abdalmajeed.rahman@univsul.edu.iq

Abstract

Small dams are crucial in water resource management, particularly in regions with water scarcity and climate unpredictability. Despite their cost-effectiveness, the construction of small dams often lacks engineering standards, which raises concerns about their long-term stability and safety. This study reviews the design, construction, stability, and protection of small dams, emphasizing the importance of proper site selection, geological and hydrological studies, and advanced methodologies such as Geographic Information Systems (GIS) and multi-criteria decision-making approaches in dam evaluation. Furthermore, the study highlights the significance of detailed planning, material selection, and quality construction to ensure dam longevity. It also discusses the role of modern tools like HEC-HMS, HEC-RAS, and GeoStudio in assessing flood risks, seepage, and stability. Inadequate design, particularly in the face of extreme weather events, can lead to dam failures, emphasizing the need for comprehensive planning and rigorous assessments. Through an analysis of various studies and case examples, this paper aims to provide insights into sustainable small dam construction and water resources management practices that ensure their effectiveness and resilience in addressing water scarcity challenges.

Keywords: Small Dam Construction, Water Resource Management, Stability Analysis, Construction Practices, Site Selection, Hydrology.

Effect of Nano, Inorganic and Organic Fertilizers on Melon Plants (*Cucumis melo* L.) Growth in Greenhouse Cultivate by Transplanting and Direct Seeding

Tariq Faruq Sadiq1&[2], Masami Takahata1, Abdulla Aram Abdulla[1], Hirokatsu Utagawa[1], Kamaran Abdulkhalq Abdulmajid3, Farhad Jamal Hasan4, Berivan Muhsin Azeez[4], Saedgull SaedAli[4], Salar Husein Ali[4], Kamaran Murshid Salih[4]

Sabat Project (Agriculture coordination project between JICA and Ministry of Agriculture and water Resources) Erbil, Iraq.

Department of Soil and Water, College of Agricultural Engineering Sciences, Salahaddin University-Erbil, Iraq.

Erbil Agriculture Research Center/ Grdarahsa Station- Erbil, Iraq.

General Director of Agriculture Research and Extension, Director of Agriculture Training Center on Region-Erbil, Iraq.

Agriculture Training Center on Region-Erbil, Iraq.

Abstract

This study was conducted to determine the effect of different fertilization strategies- NPK- based nano fertilizer, commercial fertilize and organic fertilize as well as planting method (transplanting and direct seeding) on productivity and melon quality when cultivated in a greenhouse. The study was laid-out in randomized complete block design in greenhouse, including five treatments Control (without adding any fertilizer), NPK fertilizer (20:20:20) 300kg/ha, Nano fertilizer (10:12:12) was added at the rate 150ml in 200 L ha-1 , NPK Foliar fertilizer (20:20:20) 20 g L-1 and organic fertilizer was added at the rate 20 L in 300 L ha-1 through fertigation in 4 doses 22, 37, 73 and 93 days after the sowing date. As well as two planting methods transplanting and direct seeding. Various growth parameters had been measured, such as plant height, leaf chlorophyll content, fruit weight, diameter, and sugar content. The results indicated that overall fertilizers application and planting methods significantly ($p \leq 0.01$) increased studied parameters. The tallest plant was 172.6 cm was obtained in plots planting by direct seeding and adding NPK fertilizer (20:20:20) fertilizer. Similarly, direct seeding plants treated with either NPK fertilizer (20:20:20) or Nano fertilizer (10:12:12) recorded higher fruit weight (up to 35.6 kg plot-1), larger

fruit diameter (up to 44.5 cm) and fruit sugar content (8.8%), compared to controls with the lowest values (6.7 kg plot-1 , 42.2 cm and 7.2%). The results suggest that the direct seeding with balanced NPK fertilizer (20:20:20) and Nano fertilizers application can be recommended for growing melon in greenhouse.

Keywords: Nano Fertilizer; Melon Plant; Planting Method; Organic Fertilizer; Greenhouse.

Biocontrol potential of *Bacillus siamensis* strain against *Fusarium solani*causal agent of olive tree dieback in Tunisia

Rahma MALLEK[1,2], Manel CHEFFI[1], Houda GHARSALLAH[1], Karim ENNOURI[1], Monia ENNOURI[1] and Mohamed Ali TRIKI[1]

[1] *Laboratory of Genetic Resources of Olive Tree: Characterization, Valorization and Phytosanitary Protection, Olive Tree Institute, Sfax-Tunisia*
National Engineering School of Sfax, Sfax-Tunisia Rahma.mallek599@gmail.com ; *cheffimanel@yahoo.fr ; houda_gharsallah@yahoo.fr* and *mohamedalitriki2@gmail.com*

Fusarium solani is one of the most polyphagous soilborne phytopathogenic fungi causing severe dieback symptoms in olive tree orchards. Climate change affects the severity of this disease by altering temperature and humidity patterns, creating more favorable conditions for fungal proliferation, increased pathogen survival and the expansion of their geographic distribution. Currently, plant fungi are managed by the excessive use of chemical fungicides causing several undesirable effects on the environment and human health. This prompted the development of more sustainable approaches mainly based on biocontrol and the use of microbial agents. The aim of this work is to evaluate *in vitro* and *in vivo* the antifungal activity of *Bacillus siamensis* and to study some of biological potentiality of this endophytic strain.
The antifungal activity and the biological potential of the endophytic bacterium
Bacillus siamensis was evaluated *in vitro* and *in vivo* by various methods.

The strain isolated from olive tree (*Olea europaea* L.) rhizosphere was identified as *Bacillus siamensis* using morphological identification and 16S rRNA gene sequence analysis. This endophytic strain has a broad-spectrum antifungal activity to various phytopathogenic fungi, of which the inhibition of *Fusarium solani* mycelial growth was 51.63 % and 100 % respectively using the dual culture and volatile organic compounds (VOCs) methods. Culture supernatant was also effective to inhibit the fungal growth in PDA plates and the conidial germination of this pathogen in different concentrations.
This highest inhibition of mycelial growth and conidial germination is due to the synergistic effect of multiple mechanisms, which could be explained as the production of lytic enzymes (amylase, cellulase and protease ...) and

extracellular bioactive compounds secreted into culture supernatant. The biosynthesis of lipopeptides was further confirmed by the detection of the corresponding biosynthesis genes using specific primers. This lipopeptides were effective to inhibit mycelial growth at different conditions.
Finally, the antifungal potential of *Bacillus siamensis* was confirmed *in vivo* by a test carried out on potato tubers. This endophytic strain significantly decreased dry rot of potato tubers caused by *Fusarium solani* by more than 50% compared to the inoculated and untreated tubers.

Bacillus siamensis strain and its secreted bioactive compounds could be used as new sources of potential biocontrol agent against several plant pathogens.

Keywords: Endophytic, Phytopathogenic fungi, antifungal activity, lytic enzymes and lipopeptidesThis highest inhibition of mycelial growth and conidial germination is due to the synergistic effect of multiple mechanisms, which could be explained

Machine Learning-Based Hydrological Modeling for Water Scarcity Assessment in the Kurdistan Region of Iraq

Arkan H. Ibrahim[1] **Abdulla A. A.**[2]

[1,2,]Department of Water Resources Engineering, College of Engineering, Salahaddin UniversityErbil, Erbil, Kurdistan Region, Iraq.

[1,]Department of Civil Engineering, College of Engineering, Salahaddin UniversityErbil, Erbil, Kurdistan Region, Iraq.

Abstract

The Kurdistan Region of Iraq struggles with water resource management because of unpredictable climate patterns alongside its dependency on water from surrounding regions and growing local water needs. Existing hydrological models cannot effectively represent the intricate nonlinear connections between precipitation and streamflow patterns. The research employs the advanced machine learning method eXtreme Gradient Boosting (XGBoost) to enhance predictions of water flow by studying precipitation and discharge statistics from Erbil, Duhok, and Sulaimaniyah.

The historical hydrological records underwent preprocessing to replace missing values while generating lag features and normalizing datasets. The XGBoost model received training from 80% of the dataset while 20% of the data was utilized to validate the model. Hydrological model performance was assessed through Root Mean Square Error (RMSE), Coefficient of Determination (R^2), and Nash-Sutcliffe Efficiency (NSE). The analysis revealed high prediction accuracy values (R^2 = 0.87, NSE = 0.85) which confirmed XGBoost's capability to capture hydrological patterns.

Long-term precipitation and streamflow patterns could be predicted by the model which helped evaluate flood risks while facilitating water allocation and drought planning. The model faces difficulties predicting extreme hydrological events because it struggles with years of peak floods and prolonged drought periods. Subsequent studies need to combine climate change forecasts with other hydrological data points like evapotranspiration while utilizing hybrid systems that merge physical simulations with machine learning algorithms.

Research indicates that machine learning-driven hydrological forecasts offer valuable tools for achieving sustainable water resource management in semi-arid areas. The study's results provide essential information that

enables policymakers alongside engineers and water authorities to develop strategic decisions based on data for climate adaptation and water security initiatives.

Keywords: XGBoost hydrological forecasting, sustainable water management, semi-arid areas, Kurdistan Region, climate adaptation.

Novel pH-Sensitive Indicator Films Based on Carboxymethyl Cellulose and Red Onion Peel Anthocyanins: Fabrication and Characterization

Khaoula Elhadef [1], Moufida Chaari [1],Sarra Akermi[1], Slim Smaoui [1]

[1] Laboratory of Microbial, Enzymatic Biotechnology and Biomolecules (LBMEB), Center of Biotechnology of Sfax, University of Sfax-Tunisia, 3029 Sfax, Tunisia

Abstract

The development of pH-sensitive intelligent films represents a significant advancement in packaging technology, offering a visually discernible method to monitor the freshness of perishable foods. This study introduces a novel pH-sensing indicator film based on carboxymethyl cellulose (CMC) incorporated with anthocyanins extracted from red onion peel (*Allium cepa L.)* (OPAE) at concentrations of 0% and 0.41%. The films were fabricated using the casting method and evaluated for their physical (moisture content, swelling index, water solubility and biodegradability), mechanical, and functional properties to assess their suitability for food packaging applications. The addition of anthocyanins increased the films' physical proprities, and thickness, while enhancing their mechanical performance. Specifically, the incorporation of 0.41% OPAE led to a increase in tensile strength from 6.55 MPa to 6.87 MPa, while elongation at break improved from 90.26% to 105.2%, indicating enhanced flexibility. Moreover, films containing OPAE exhibited superior thermal stability compared to pure CMC films. Fourier transform infrared spectroscopy (FTIR) confirmed the successful incorporation of OPAE into the CMC film matrix. . Additionally, the developed films exhibited a higher antioxidant and antibacterial activity against food-borne pathogens. Functionally, the fabricated films demonstrated distinct and rapid color changes in response to variations in pH, making freshness monitoring easily perceptible to the naked eye. Given their favorable mechanical properties, color responsiveness, and potential antimicrobial benefits, these CMC-OPAE based films present a promising approach for intelligent food packaging, contributing to improved food safety and quality.

Keywords: pH-sensitive film, Red onion peel extract (OPAE), Food safety and quality

Analysis and representation of terrain characteristics to select the optimal locations for solar cells in Zakho-Dohuk district using RS- GIS technology

Prof. Dr. Ali Majeed Yasseen [1]

[1] Republic of Iraq - Dhi Qar University / College of Arts Department of Geography

alimajeed@utq.edu.iq

Abstract

There are several requirements for selecting solar cell sites, including those related to terrain characteristics, which work to provide the greatest amount of solar photovoltaic energy to the cells, and then achieve the maximum practical feasibility in selecting the optimal site. To achieve this, we rely on analyzing the digital data of the digital elevation model (DEM) from the USGU website in the United States of America www.earthexplorer.usgs.gov, the radar visualization from the Aster Global DEM satellite, and then processing the digital elevation model by filling in the data gaps by importing the file from the Global Mapper program in the form of a DEM Raster. This is done according to a number of steps, which are: adding a Model from the main interface of the program, opening the Model Properties menu and then going to Environment to determine the path of the model, in addition to including spatial analysis tools within the model that was built, which are (contour lines), (slope), (slope direction - Aspect), and then determining the criteria for the preferred location for establishing solar cell farms (Raster Calculator), which are: the height ranges between (160-300 m), the slope between (10-40), the slope direction is towards the southeast, south and southwest (112.5-247.5), the research aims to achieve sustainable development of renewable energy sources to compensate for the shortage in the provision of electrical capacity in the northern regions, especially villages in mountainous and remote areas that are not reached by power transmission lines.

Keywords: Digital elevation model, solar farms, remote sensing and Geographic information systems.

Mapping Kurdistan's Water Bodies on Google Maps: A Comprehensive Initiative for Climate Resilience and Resource Management

Akam Aziz [1]
[1] University of Raparin
akamaziz@uor.edu.krd

Abstract

Water bodies such as lakes, ponds, and dams are critical resources for environmental sustainability, economic development, and climate resilience. This paper presents a comprehensive effort to map and update all water bodies across the Kurdistan Region, achieving 98% representation on Google Maps. By utilizing advanced geospatial tools and field data, this initiative enhances accessibility to vital hydrological information for policymakers, researchers, and the public.

The mapping effort contributes to climate adaptation by improving water resource management, enabling better planning for agriculture, flood control, and sustainable development. Furthermore, it addresses the challenges of water scarcity and ecosystem conservation by providing an accurate, dynamic database for decision-making. This project serves as a model for integrating technology and local knowledge to foster regional and global climate resilience. Through this initiative, we aim to inspire similar actions in other regions, demonstrating the power of collaborative efforts to safeguard our planet's most vital resources.

Keywords: Google Maps, Water Resource Management, Kurdistan Region, Climate Change Adaptation, Geospatial Mapping.

Allelopathic effects assessment of walnut extract as a herbicide on seed germination and seedling growth characteristics of wheat, wild barely, and mustard rape

Pakhshan Mustafa Maulood [1]
Assis. Prof.

Dalshad Azeez Darwesh [1]
Prof.

[1] Biology Department, College of Science, Salahaddin University -Erbil, Iraq. Environmental Sciences and Health Department, College of Science, Salahaddin University -Erbil, Iraq.
e-mail: pakhshan.maulood@su.edu.krd, dalshas.darwesh@su.edu.krd

Abstract

Juglone toxicity to herbal and woody plants makes it a preferable natural herbicide. Due to its short half-time and high degradation, it was considered toxicologically and environmentally safer than synthetic pesticides.

The study aims to evaluate the leaf and husk of walnut (Juglone regia L.) extract as a herbicide and use it to control herb invasion and weed management. The herbicidal effects on wheat (Triticum aestivum L.), Wild barely (Hordeum spontaneum Koch.) and Mustard rape (Brassica napus L.) were assessed on both seed

germination and vegetative growth (seedling growth). Results revealed that the inhibitory effect of walnut extract reduced germination % of wheat from 100% for control treatment to 83.3 and 53.3% for 15% treatment in both leaf and husk, respectively. Seed vigor index of wheat was more influence by husk than leaf extract, which reduced to 0.12 and 6.19% respectively. For wild barley and mustard rape inhibition percentage was 100%, and seed germination characteristics were completely reduced to zero. On the other hand, wheat seedling growth was not affected by foliar spraying of leaf and husk extract except for the weight of 1000seeds, which reduced to 3.21 and 3.18gm respectively in 15% treatment. While in wild barley, the reduction in plant length and length of the spike was observed for husk extract. The mustard rape was more influenced by walnut extract for all seedling growth characteristics except the dry weight of the shoot was not affected. Generally, walnut leaf and husk extract could be used for inhibition growth of wild barley and mustard rape in wheat cultivation fields.

Keyword: Allelopathy, walnut extract, leaf and husk, wheat, wild barley, mustard rape, herbicide.

Recent Developments in Electricity Generation from Biomass Residue

Shadan R. Abubaker [1] Mustafa Aslan [2]

[1] Department of Fish resource and aquatic animal, College of Agriculture, University of Salahaddin, Erbil/Iraq.

[2] Harran University. Engineering Faculty Department of Environmental engineering 63100 Şanlıurfa/ Turkey

Abstract

Anaerobic digestion of biogas for electricity generation is a renewable form of energy. This research area is gaining momentum among researchers and environmentalist due to the promising nature of the technology in contrast to use fossil fuels, which has an adverse effect on the ecosystem at large. Biogas is currently used in automobiles and gas turbines for electricity generation. Several biochemical, physical and biological factors needed for the production of biofuels. Currently there are several reactors used to for biofuels and in particular, biome thane. Such reactors include fluidized bed reactor, batch, semi-batch, and continues type of rectors. The advantages of the technology is that the digestate can be reused for agricultural purposes as rich in nitrogen, potassium and phosphorus. That the aim of this review is to expanciate on the trends in biofuels for electricity generation as well as the process involved in biogas generation.

Keywords: Biofuel, electricity generation, renewable energy, biomass, and bioreactors.

Evaluation of Renewable Energy Policies in a Developing Economy: Comparative Analysis of the United Kingdom with the Kurdistan Region of Iraq

Nivar Mohamad[1]

[1] King's College London masters graduate and civil servant at the Kurdistan Region Presidency (KRP)

Abstract:

This mixed-method research study investigates the challenges and opportunities in implementing renewable energy (RE) policies in the Kurdistan Region of Iraq (KRI), with a focus on the electricity sector—a major contributor to climate change due to its inefficiency and reliance on fossil fuels. The study addresses gaps in the literature concerning renewable energy policy frameworks in developing regions like KRI, where transitioning to sustainable energy is essential for both improving energy efficiency and combating climate change.

The study highlights the complexity and novelty of implementing large-scale renewable energy policies in KRI, given its unique socio-economic and geopolitical challenges. Existing research has been limited in exploring the practical impacts of these policies on local implementation and governance practices. Through semi-structured interviews with senior leaders in KRI and a survey of renewable energy experts, this research identifies significant financial, technical, and socio-political barriers to RE adoption in KRI. These include reliance on international support, insufficient technological infrastructure, and public resistance.

Interviews with KRG leaders revealed that financial constraints, largely due to budget deficits linked to strained relations with Baghdad, are a significant barrier. Survey data confirmed these financial challenges and highlighted widespread skepticism regarding government effectiveness in policy implementation. Technological barriers and public resistance were also identified, with younger respondents showing more optimism about RE's future compared to older leaders. The skepticism extends to the feasibility of implementing Feed-in Tariff (FIT) policies in KRI, with leaders favoring more

realistic approaches like net- metering.

By conducting a comparative analysis with the United Kingdom—a country with a proven track record in RE policy implementation—this study aims to identify lessons that can be adapted to KRI's context. The UK's Climate Change Act (2008) serves as an example of an effective legislative framework, setting legally binding targets for reducing greenhouse gas emissions and establishing independent oversight bodies like the Committee on Climate Change (CCC). While these frameworks have been instrumental in the UK's success, their immediate application to KRI faces significant challenges due to the region's unique socio- political and economic conditions.

The research underscores the need for KRI to implement legally binding targets and establish independent bodies to monitor emissions and provide a roadmap for a low-carbon economy. Although respondents in KRI show a lack of confidence in their government, a tailored legal framework could address implementation gaps and ensure government accountability.

The study emphasises the critical role of leadership in overcoming barriers to RE adoption and highlights the importance of tailoring policy adaptations to KRI's specific context. A bottom-up approach, complementing top-down strategies like the SES 2030 plan led by the PM's office, is crucial for raising public awareness and fostering stakeholder collaboration. Addressing both structural and perceptual barriers is essential for KRI to meet its 2030 targets and align with international standards.

To overcome financial barriers, the KRG could adopt strategies similar to the UK's Green Deal, offering government-backed loans or subsidies for RE installations. However, high borrowing costs in KRI remain a significant barrier. Introducing incentives like reduced interest rates for RE-specific loans could encourage wider participation in the energy

transition. Additionally, market reforms promoting competition and private sector engagement are essential for replicating the UK's success in RE development.

This study improves policy transfer theory by illustrating the complexities of adapting policies like the FIT to regions with different socio-economic and political conditions. The findings highlight the need for context-specific adaptations, supporting the view that successful policy transfer involves

understanding local conditions and modifying policies accordingly. While KRI faces significant financial, technical, and infrastructural challenges, the region shows a positive outlook for the future of RE, with substantial efforts underway to secure technical support, attract international funding, raise public awareness, and develop effective policies. The study concludes by recognizing its limitations and offering implications for future renewable energy policy development in KRI, alongside opportunities for further research.

Keywords: Energy Policios Comparative UK. KRG-IRAQ

USE TWO ALGAL GENERA AS A NATURAL ANTIBIOTIC AGAINST SOME PATHOGENIC BACTERIA

J. Toma[1] F. H.Aziz[1] A. M. Hanna[2]

[1] Dep. of Environmental Sciences and Health –Coll.of Sci- University of Salahddin, Kurdistan Region of Iraq.

[2] Dep. of Chemistry –Coll.of Sci- University of Salahddin, Kurdistan Region of Iraq.

Email: janan.toma@su.edu.krd

Abstract

The increasing resistance has necessitated of bacteria that causes diseases has made it necessary to search for alternative antimicrobial factors. Algae, such as Cladophora glomerata (OM478590), and Chlorella sorokiniana (MH923012) have been studied for their bioactive compounds with antibacterial characteristics. Evaluate this study the antibacterial activity of both algal genus mention above extracts against four human pathogens like Acintobacter baumanii (ATCC: 19606), Klebsiella pneumonia (ATCC: 13883), Enterococcus faecalis (ATCC: 29212) and Staphylococcus aureus (ATCC: 14028). Extracts were prepared utilizing ethanol and hexane solvents and tested by using 96-well microtiter plate's method. Results showed that C. glomerata showed the minimum inhibitory concentration (MIC) was highest at 2 $mg.ml^{-1}$ in Acintobacter baumanii and Enterococcus faecalis. While, Chlorella sorokiniana considered the less effective against pathogenic bacteria than other algae, which the MIC was highest at (5mg.ml-1) against in most pathogenic bacteria. In regarding to phytochemical studies, algal mentioned above diagnosis many compounds in it by GC-MS screening. Most of these compounds were having various antibiotic actions, chemical substances that may notice antioxidant and anticancer. Some of these compounds were found in the extract by ethanol

or hexane solvents. Like Acetamide, Aldehyde, Alcohol, Dimethyl, Benzene, Aceter, Ketone, Heterocycle, Alkane, Furan, Propanoic acid, Tetrazole, Acetic acid, Allyl acid, Butanic acid, Heptanone, Octanedione, Amylene Hydrate, Formamide, Dioxolane, Propanal, and others.

Keywords: Algae, Antibacterial, Solvent, Ethanol, Hexane, Diseasess

Development and Characterization of Sodium Alginate-Based Edible Films Enriched with Purple Cactus Pear Peel Extract for Sustainable Food Packaging

Moufida Chaari[1], Eider Matxinandiarena[2], Khaoula Elhadef[1], Alejandro J Müller[2], Slim Smaoui[1]

[1]Laboratory of Microbial, Enzymatic Biotechnology and Biomolecules (LBMEB), Center of Biotechnology of Sfax, University of Sfax-Tunisia, 3029 Sfax, Tunisia
[2]POLYMAT and Department of Polymers and Advanced Materials: Physics, Chemistry and Technology, University of the Basque Country UPV/EHU, Paseo Manuel Lardizábal 3, 20018 Donostia-San Sebastián, Spain

Abstract

The increasing demand for biodegradable and functional food packaging materials has driven extensive research into sustainable alternatives. Among these, sodium alginate—a widely utilized polysaccharide—has emerged as a promising candidate for the development of eco-friendly, biodegradable films for food packaging applications. This study aimed to develop sodium alginate-based edible films enriched with varying concentrations of purple cactus pear (*Opuntia stricta*) peel extract (PCP) at 0, 0.18, and 0.27%, and to evaluate their functional properties. The incorporation of PCP into sodium alginate films resulted in enhanced tensile strength, ranging from 5.89 to 7.35 MPa. Additionally, the elongation at break values of the sodium alginate-PCP films increased compared to pure sodium alginate films, varying from 53.87% to 69.05%, indicating improved flexibility. In terms of thermal stability, films with the highest PCP concentration (0.27%) exhibited superior thermal resistance compared to other film samples. Furthermore, SEM and FTIR analyses confirmed the successful incorporation of PCP extract into the sodium alginate film matrix, with clear evidence of molecular interactions between the film components and the bioactive compounds present in the extract. These findings highlight the potential of sodium alginate- based films enriched with PCP as a sustainable and functional food packaging solution.

Keywords: Sodium alginate; Purple cactus pear peel extract; Biodegradable packaging; Edible films

Optimisation de la production, extraction et immobilisation en hydrogel de la phycoérythrine de Porphyriduim sp.

Hajer Ben Hlima[1]

Laboratoire de Génie Enzymatique et de Microbiologie (LGEM), LR03ES08, Ecole Nationale d'Ingénieurs de Sfax, Université de Sfax
Correspondance to: hajer_benhlima@yahoo.fr

Abstract

The scientific community is increasingly interested in natural food colors since synthetic dyes can cause health problems. Among the natural dyes, phycoerythrin, a chromoprotein found in red microalgae, attracts the attention of many researchers. This study was done in this context, it begins with the production of B-phycoerythrin from the red microalga Porphyridium sp., the study of its biological activities and its incorporation into a hydrogel. The optimization of the production factors using the Box-Behnken experimental design gave a maximum production of B-PE equal to 4.71 ± 0.075% under the following conditions: NaCl = 37 g/L; MgCl2 = 8.6 g/L and CaCl2 = 1.625 g/L. B-PE also showed interesting ability to scavenge DPPH (IC50 = 0.0784 mg/mL) and ABTS (IC50 = 0.66 mg/mL) free radicals and iron reducing power (OD700nm = 0.318 ± 0.0045 at 0.370 mg/mL). Minimum inhibitory concentration (MIC) values were determined against four foodborne bacteria: Staphylococcus aureus ATCC 6538, Salmonella enterica ATCC 14028, Listeria moncytogenes ATCC 19117 and Escherichia coli ATCC 8739. Novel xanthan gum-based hydrogels were also obtained by crosslinking in basic medium using a non-toxic crosslinking agent: sodium trimetaphosphate (STMP). Three hydrogels with xanthan gum concentrations of 3%, 5%, and 7% were prepared. The hydrogels were characterized in terms of swelling rate and ability to encapsulate phycoerythrin. The results showed that the synthesized hydrogels were pH sensitive. The swelling degrees were higher for hydrogels with 3% xanthan gum. The cumulative release rates of B-PE in deionized water from GX3-STMP, GX5-SMTP, and GX7-SMTP hydrogels were 71%, 44%, and 49%, respectively.

Keywords: Imnobilisation, Optimisation, Hydrogel.

Mitigating Methane Emissions from an Erbil Waste Dumping Site: A GIS-Based Approach to Detection and Conversion into a Green Landscape

Prof. Dr. Shuokr Qarani AZEEZ **Bala Kawa M. Saleem**

[1] College of engineering, Salahaddin University, Erbil 44001, Iraq; shoker71@yahoo.com
Dalshad Ahmed Kareem
Erbil Technology College, Erbil Polytechnic University, Erbil 44001, Iraq; dilshadahmedkareem@gmail.com

[2] General Directorate of Water and Sewage, Ministry of Municipalities and Tourism, Erbil 44001, Iraq; bala.kawa@yahoo.com

Abstract

This work uses Geographic Information System (GIS) technology, particularly ArcMap, to address the serious environmental issue of methane (CH4) leaks from an Erbil waste dumping site. The aim of this research is to identify and analyze methane concentrations in the neighborhood of the dumping site, offering significant data for environmental monitoring and mitigation techniques.

The methodology involves the integration of spatial data, satellite imagery, and ground measurements to map and quantify methane emissions. ArcMap serves as a powerful tool for spatial analysis, allowing for the identification of emission hotspots and the assessment of their impact on the surrounding environment. The findings contribute to the understanding of the spatial distribution of methane emissions, enabling targeted interventions to reduce environmental harm.

The findings enable further clarify the area-by-area distribution of methane emissions, allowing for more focused efforts to limit damages to the environment.

Furthermore, the research investigates sustainable alternatives to reducing methane emissions by identifying that the garbage dumping site be converted into a green area and, eventually, a forest. This transformation is a large-scale and environmentally significant project that necessitates

careful plan ning, long-term commitment, and coordination among diverse stakeholders. Municipalities, environmental physicians, as well as local support are critical to the achievement of this endeavor. Beyond methane reduction, the benefits of transforming the dumping site into a green space include improved air quality, increased biodiversity, and the construction of a community recreational area. To assure the success and sustainability of the transformation effort, the study highlights the necessity for a comprehensive plan that incorporates ecological, social, and economic factors.

Finally, this study not only extends to our awareness of the release of methane from waste disposal sites, however it also advocates for the conversion of such sites into environmentally beneficial landscapes. It illustrates the necessity of partnership and long-term planning in addressing environmental concerns and promoting the well-being of both the ecosystem and those who live there.

Keywords: GIS, Methane gas, Erbil waste dumping site, Green area, environmental

Innovative Bioactive Edible Films from Bovine Gelatin Enriched with Biomass, Phenolic, and Protein Extracts of Two Green Microalgae Species

Wafa Taktak*[1], Hajer Ben Hlima[1], Slim Smaoui[2], Slim Abdelkafi[1]

[1]Laboratoire de Génie Enzymatique et Microbiologie, Equipe de Biotechnologie des Algues, Ecole Nationale d'Ingénieurs de Sfax, Université de Sfax, Sfax 3038, Tunisia

[2]Laboratory of Microbial Biotechnology and Engineering Enzymes (LMBEE), Center of Biotechnology of Sfax (CBS), University of Sfax, Road of Sidi Mansour Km 6, P.O. Box 1177, Sfax 3018, Tunisia Emails: wafa.taktak@gmail.com;hajer_benhlima@yahoo.fr;slim.smaoui@cbs.rnrt.tn;
slim.abdelkafi@enis.tn.
Corresponding author: wafa.taktak@gmail.com

Abstract

The study focused on the expansion and the characterization of novel active food packaging blend films based on bovine gelatin and the assessment of biomolecules extracted from two green microalgae species, Chlorella vulgaris and Chlorella pyrenoidosa as well as biomass, ethanolic and protein extract. Then the effects of the Chlorella biomolecules incorporation at different levels on physical, thermal, mechanical and biological properties of gelatin films were investigated. FTIR was carried out to observe the potential modifications of the gelatin- based films when incorporated with chlorella biomass, ethanolic extract and protein. Data demonstrated that the incorporation of these biomolecules especially biomass to the gelatin- based film formulation decreased the lightness of composite films. Consequently, the biomass integration into gelatin-based films based significantly affects the color and light absorbance of resulting films in a dose-dependent manner. Moreover, the addition of biomolecules improve thermal stabilization of the gelatin chain, as evidenced by a decrease in the maximum degradation temperature of the protein in the blend film. Furthermore, the DRX analysis of blend film revealed a shift in the position and the intensity of the peak at 20° related to gelatin film (control) which may indicate the interactions between gelatin and the biomolecules introduced as well as the hydrogen bond formation. The attained results suggested that integration of chlorella biomass and ethanolic extract into gelatin films improved mechanical

and barrier properties. Furthermore, ethanolic extract and protein addition into the gelatin matrix enhanced the blend films antioxidant activities with different tests. The obtained gelatin edible films incorporated with extracted chlorella biomolecules showed great potential to be used for active food packaging due to its interesting physicochemical and biological properties.

Keywords: *Chlorella;* Active packaging; Gelatin based-film; Antioxidant; DRX; Mechanical and thermal properties.

Design, Operational Limitations, and Economic Analysis for Animal Waste Biogas Plant and Relation Combined with Artificial Intelligence

Sarwah Othman Ismael[1*] and Shuokr Qarani Aziz[2]

[1and 2] Department of Civil Engineering, College of Engineering, Salahaddin University-Erbil, Kurdistan Region, Iraq
E-mail: srwa_othman90@yahoo.com , srwa.ismail@su.edu.krd

Abstract

Biogas, an environmentally friendly and sustainable energy source, is created by the anaerobic digestion of organic materials such as municipal solid waste, animal dung, and sewage sludge. Methane (55-75%), carbon dioxide (25-45%), nitrogen (0-5%), hydrogen (0-1%), hydrogen sulfuride (0-1%), and oxygen (0-2%) make up this promising renewable energy source for producing heat and power. It is an essential energy source for producing heat and power. This research aims to design a biogas plant using various substrates like cow, sheep, and goat manure mixed with fresh biomass to enhance biogas production for a small Bnaslawa village- in Erbil, Kurdistan Region, Iraq. Additionally, artificial intelligence with biogas has been studied. The analysis goes on to demonstrate that the study area's cows, sheep, and goats may produce 2876200 kg/year of manure and 95630 m3 of biogas daily, with the region's caws and sheep
producing the most waste. This research proposes that only three animals, cows, sheep, and goats, yield 172.134 MWh of electrical energy annually, with the cow accounting for 41%, the sheep for 42%, and the goat for 17%. The study highlights the potential of biogas energy and the advantages of using animal waste to produce electricity, underscoring the significance of sustainable energy sources and effective waste management techniques.

Keywords: Animal Waste, Artificial Intelligence, Biogas Design, Bnaslawa-Erbil City, Economy.

Exploring the Consequences of Climate Change on the Healthcare Sector in Kurdistan (North Iraq): A Research Perspective University of west Attica

Keivan simko

University of west Attika

Abstract:

Climate change has emerged as a pressing global issue with far-reaching implications for various sectors, including healthcare. This research study aims to explore the consequences of climate change on the healthcare sector in Kurdistan (North Iraq) from a research perspective.

The escalating threat of climate change poses significant challenges to numerous sectors worldwide, including healthcare. This research endeavor delves into the ramifications of climate change on the healthcare sector in Kurdistan, specifically focusing on North Iraq. Through a research-oriented lens, this study seeks to illuminate the multifaceted impacts of climate change on healthcare delivery, infrastructure, and outcomes in the region. By employing a comprehensive approach, encompassing data analysis, stakeholder perspectives, and interdisciplinary insights, the study aims to elucidate the vulnerabilities, resilience, and adaptation strategies within the healthcare sector. Ultimately, this research endeavors to contribute valuable insights that can inform policy responses and foster sustainable healthcare practices in the face of climate change.

Keyword: Climate change, Adaptation strategies, Vulnerabilities, Resilience, Policyresponses,Sustainablehealthcare.

Site-Specific Evaluation of SBR Systems for Water Treatment Using Advanced Environmental Indices in Two Urban Locations within Erbil City

Muzhda Qasim Qader [1] & Bakhtyar Abdullah Othman[2]

[1,2] Department of Public Health, Hawler Medical University, Kurdistan Region, Iraq

Email: muzhda.qadir@hmu.edu.krd , ORCID ID: https://orcid.org/0000-0002-3561-7137

Abstract

The study evaluated the performance of a Sequencing Batch Reactor system in two stations within Erbil, for improvements in water quality. The results showed significant improvements post-treatment. Turbidity decreased by 92.8% at S1 and 81.34% at S2, while TSS reduced by 90.62% at S1 and 88.12% at S2. PRE-values for COD was 77.45% at S1 and 86.22% at S2 while the BOD values were 85.84% at S1 and 91.26% at S2. Effective aeration was observed with dissolved oxygen rised from 4.9 mg/L to 7.1 mg/L at S1 and from 2.6 mg/L to 6.3 mg/L at Station 2. The nitrate and phosphate concentrations reduced to 0.75% and 0.16% at S1 and 0.27% and 0.07% at Station 2. The Environmental Risk Index calculations reduced to 0.38 in Station 1 and 0.41 in Station 2 for pretreatment and enhanced to a considerably lower 0.15(S1) and 0.12(S2) post treatment. Pollution Load Index (PLI) also reduced from 3.45 to 1.31 in Station 1 and in Station 2 was 3.16 to 1.19 which clearly indicated the pollution load have reduced significantly. After treatment, WSI raised to 0.096 for S1 and 0.087 for S2. Some of the observed indices were the Comprehensive Pollution Index (CPI), Environmental Risk Index (ERI), Pollution Load Index (PLI) showed that SBR system effectively lowered pollution and the environmental risks.

In addition, both the Water Suitability Index (WSI) and the Ecological Impact Index (EII) increased, which demonstrated better water quality and sustainability in the future as shown in the Sustainability Performance Index (SPI).

Keywords: Risk assessment, Sustainable technology, Advanced treatment systems, Ecological restoration, Environmental risk mitigation

Removal of Pollutants Using Nanomaterials in Advanced Wastewater Treatment

Eman Shamsaldin Ahmed and Prof. Dr. Shuokr Qarani Aziz
emanshamsaden8@gmail.com
Department of Civil Engineering at Salahaddin University-Erbil

Abstract

Nanomaterials have completely changed the wastewater treatment industry by providing creative, efficient ways to fight water pollution. Thanks to their high surface area-to-volume ratio, highly reactivity, and customizable surface chemistry, nanomaterials have demonstrated impressive promise in improving the removal efficiency of pollutants and maintaining water quality. Because of their highly interacting nature and adaptable surface chemistry, nanoparticles may be specifically customized to interact with different types of pollutants, increasing the effectiveness of treatment. The use of nanomaterials in wastewater treatment has many benefits, but there are still issues that must be properly considered in order to assure their safe and long-term use. These issues include environmental concerns, financial ramifications, and legal frameworks. Collaborative efforts focusing on research, development, and the establishment of robust guidelines are crucial to fully harnessing the benefits of nanomaterials in advancing wastewater treatment practices. In order to achieve sustainable water management and pollution reduction, the area of nanomaterial-based wastewater treatment is well-positioned to make major advancements through the investigation of new synthesis processes, the promotion of responsible uses of nanotechnology, and the integration of real-time monitoring models.

Keywords: Nanomaterials, Wastewater treatment, Pollutant removal, Adsorption.

Impacts of Pollution and Siltation from Flowing Waters on Lakes in the Kurdistan Region and Strategies for Restoration to Mitigate These Threats

Rabar Mohammed Hussein[1]

[1] Medical Laboratory Technician, Noble Technical Institute, Erbil, Iraq.

corresponding: rabar.hussein@noble.edu.krd

Abstract

Lakes in the Kurdistan Region of Iraq face significant environmental challenges due to pollution and siltation, primarily from the inflow of sediments and contaminants via rivers and streams. This review explores the causes and effects of pollution and siltation on these freshwater ecosystems, highlighting their impacts on water quality, biodiversity, and ecosystem services. Furthermore, the paper discusses various strategies for restoring and mitigating these threats, including pollution control, sediment management, and sustainable land-use practices. The findings aim to provide a framework for effective lake management and conservation in the Kurdistan Region.

Keywords: Pollution, Siltation, Lakes, Kurdistan Region, Restoration, Water Quality, Eutrophication, Sediment Management, Sustainable Agriculture, Wastewater Treatment .

Contamination of some edible plants by harmful heavy metals, and their efficiency to uptake and Bioaccumulation

Karzan Mohammed Khalid

University of Soran

Abstract

Now a day, edible plants are considering as medicinal plants and proposed potent substitutes for synthesized medical supplements. Therefore, urban farming and irrigation must be qualified to meet the people demand, especially the water resource of irrigation and chemical plant growth factors. In this study, three edible plants (Eruca sativa Mill., Apium graveolens L. and Lepium sativum L.) were harvested from Turaq Quarter of Erbil City, and prepared for screening heavy metal contents; including Arsenic (As), Chromium (Cr) and Iron (Fe), using ICP_MS. As a result, the plants were contaminated by As, Cr and partially Fe as compared to their maximum permissible level (MPL). The maximum concentrations of As, Cr and Fe were 0.85, 0.80 and 800 mg/l in root tissues of E. sativa, and significantly higher than MPL in plants (0.1, 0.02 and 425 mg/l), respectively. Furthermore, the percentage increased part of MPL for the accumulated metals were ranged in (54-88% As, 30-87 Cr and 2-47% Fe). Whereas, the minimum concentrations of As and Cr were found in roots of L. sativum (0.22 and 0.14 mg/l), and 180 mg/l Fe in shoots of A. graveolens. L. sativum was considered as hyperaccumulator with TF>1 for As, Cr and Fe, while E. sativa and A. graveolens were announced as strong excluders and their TF was <1.

Keywords: Heavy metal, toxicity, edible plant, hyper accumulation, irrigation factors

Evaluation of Groundwater Quality in the Northern Regions of Nineveh Governorate Using the Canadian Water Quality Index (CCME WQI) and Its Drinking Water Suitability

Raghad Mukdad Mahmood[1] Ahmed Mohamed Taher[2] Ibrahim Omar Saeed[3]

Department of Biology, College of Pure Science, University of Tikrit[1].

[1]Ministry of Education / Open College of Education / Nineveh Center.[2] Department of Biology, College of Science, University of Tikrit[3]

Email / raghad.ecology@tu.edu.iq1 ,ahmed.m.taher@st.tu.edu.iq[2] Corresponding author:dr.ibrahim1977@tu.edu.iq

Abstract

The objective of the study was to utilize the Canadian Water Quality Index (CCME WQI) model to assess the potability of well water in northern Nineveh Governorate. The study encompassed an evaluation of the physical and chemical parameters, along with the concentrations of heavy metals, in the well water under scrutiny. A total of seven wells were selected on a random basis, and water samples were collected for analysis. The Water Quality Index (WQI) was then calculated based on 21 parameters, including turbidity, pH, biochemical oxygen demand, dissolved oxygen, alkalinity, total dissolved solids, electrical conductivity, total hardness, nitrates, phosphates, calcium, magnesium, potassium, sulfates, sodium, chlorides, cadmium, lead, iron, copper, and zinc. The result of the water quality index was (31.08-45.48) for sites 1 and 7, respectively, indicating that 71.5% of the wells are of poor quality and unfit for drinking, and 28.5% of the wells are marginal, and the water of the studied wells is outside the drinking water standards. The findings of this study can be utilized to formulate preventive measures aimed at controlling pollution in the study area and analogous regions where groundwater will be relied upon for drinking purposes in the future.

Keywords: Physicochemical parameters; Water pollution; Heavy metal; Well water.

Effect of biochar on quality of Soil Polluted by Dumping Leachate

Suzan.B Ismail[1] Dalshad.A Darwesh[1]

[1]Environmental Sciences and Health Dept. College of Science, Salahaddin University

Abstract

The study was carried out to determine impacts of landfill leachate on soil quality and using wood biochar as soil remediation agents. Soil samples from four equal distances and four depths (surface, 30 cm, 60 cm, and 90 cm) were collected along a leachate Chanel at Kani-Qrzhala landfill site, for determination the soil quality by using some common single and integral indices. The results of soil pH, EC and some heavy metals (Pb, Cd and Ni) show a significant variation at significant level ($P \leqslant 0.05$). The concentration of analyzed heavy metals in soil samples were arranged in the following magnitude order: Pb>Ni>Cd. The soil quality index (SoQI) had a high level concern in all studied sites which refer to high pollutant rate in soil samples, the lowest value of SoQI was recorded at site 1, that refer to the highest pollutant rate while the highest value of SoQI was recorded at site 3 refers to the lowest pollutant site. Potential ecological risk index(RI) of Pb and Ni were not more than the standard limit in all sites exception of Cd. In remediation experiments walnut shell(T_1) and oak tree wood (T_2) biochar %10 using for remediate contaminant soil by leachate. SoQI index improved after using T_1 and T_2 and the potential ecological risk index (RI) significantly reduced after using T_1 and T_2, but T_2 was more effective than T_1 to improve the SoQI and reduce RI rate, may be related to feedstock and mechanism of production biochars that affected on biochars activity and structure.

Keywords: Landfill, Leachate, Heavy metal, Biochar, Remediation

Flooding and Climate Anxiety in Erbil: Psychological Responses and Risk Perceptions

[1]Muzhda Qasim Qadr, [2]Chiayi M. Shareef, [2&3]Ahmed Naif Ali, [4]kaiwan kareemkhan fatah,

[5]Dara Abdulla Qadir

[1,] Department of Public Health, Hawler Medical University, Kurdistan Region, Iraq,

[2,4]Department of environmental science and health, Department of earth and petroleum Salahaddin university college of science.

[3]Psychiatric department, College of Nursing, Hawler Medical University, Erbil, Iraq.

[5] Department of Nursing, College of Nursing, Hawler Medical University, Erbil, Iraq.

Abstract

Climate change, Urbanization, poor infrastructure all aggravate flooding, might cause psychological, socioeconomical hazards. This paper examines flood risk perception, preparedness, psychological distress, and government response, focusing on climate anxiety determinants among affected populations in Erbil, Kurdistan Region of Iraq.

A cross-sectional study was conducted among 400 participants of flood-prone locations in Erbil. structured questionnaire was used to collected data using covering sociodemographic factors, flood experiences, preparedness behaviors, and psychological impacts. Statistical analyses included (descriptive statistics, chi-square, logistic regression, factor analysis, and polychoric correlation analysis) to determine relationships between flood experience, risk perception, preventive actions, and climate anxiety constructs.

Results showed that 87.5% of respondents had experienced floods; main reasons were inadequate drainage (59.5%), climate change (83.3%), and excessive rainfall (73.8%). Only 42.0% of those highly exposed followed preventative guidelines. Preparedness was highest predicted by flood experience (OR = 2.87, $p < 0.001$). Factor study of climate anxiety revealed emotional (38.5%), cognitive (24.3%), and functional (18.1%) disturbance. Key suggestions stressing increased drainage (80.0%), early warning systems (59.5%), and tougher urban laws (47.5%) helped to explain the government reaction dissatisfaction (75.0%). Results underline the immediate necessity of integrated flood management strategies involving improved infrastructure, mental health treatments, community readiness, and climate education. Climate resilience depends critically on strengthening policy enforcement, risk communication, and flood adaption techniques.

Keywords: Flood Risk, Climate Anxiety, Disaster Preparedness, Public Health, Government Response, Flood Susceptibility

Study of some plant species as phytoremediation of heavy metals emission from oil refinary

Zhian Rashid Salih[1], Maqsuda Qadir Muhammad [2], Wareen Farzand Kamal [3*], Runj Mouhamednajat Mazher[4],

[1,2] Biology Department, College of Education, Salahaddin University- Erbil, Iraq; [1]E-Mails: zhian.salih@su.edu.krd; [2]E-Mails: maqsuda.muhammad@su.edu.krd

[3] Department of Animal resources, College of Agriculture Engineering Sciences, Salahaddin University- Erbil, Iraq; [2]E-Mails: wareen.kamal@su.edu.krd;

[4] Department of Food Security and Quality Control, Khabat Technical Institute, Erbil Polytechnical University; E-Mails: runj.mazher@epu.edu.iq

*Corresponding Author; E-Mail: wareen.kamal@su.edu.krd

Abstract:

This study was carried out to investigate the phytoremediation potential of five different plant species (*Melia azedaracch ,Punica ranatum,Cupressus arizonica, Platanus orientalis* and *Platanus orientalis)* in the city of Erbil mitigating heavy metal emissions refinery. The research assesses photosynthetic pigments, heavy metal concentrations (Fe, Cu, Mn, Ni, Zn, As, Pb, Co, Hg and Se) from an oil, and biochemical attributes in leaves, highlighting their responsiveness to contamination. Variations in metal levels between control and polluted sites underscore the refinery's impact, while reduced photosynthetic pigments indicate potential ramifications for plant vigor. The intricate interplay between pollution levels and plant physiology is explored, offering crucial insights for effective environmental management strategies. Metals like arsenic, cadmium, lead, and mercury, commonly found in food, pose health risks due to human activities. The research underscores the significance of plants as indicators and reducers of pollutants, emphasizing the potential of phytoremediation in addressing environmental challenges. The findings contribute valuable information for developing sustainable approaches to combat pollution, particularly in industrial settings.

Keywords: Phytoremediation; Air pollution; Heavy Metals; Environmental Contamination; Photosynthetic Pigments

Investigation of Heavy Metal Contamination of Some Soil Samples in Duhok Governorate, Kurdistan Region, Iraq

Shwan Seeyan[1], * Masud Hamed[2], Kaiwan K. Fatah[2]

[1] Salahaddin University-Erbil, Agriculture Engineering Science College, Soil and Water Department.
[2] Salahaddin University-Erbil, Sciences College, Department of Earth Sciences and Petroleum.
* Correspondence: shwan.seeyan@su.edu.krd

Abstract

Environmental contamination with heavy metals detrimental effects on ecosystems. These metals can accumulate in soil, water, and plants, affecting the entire food chain, they can disrupt the balance of ecosystems, harm aquatic life, and have long-lasting impacts on biodiversity. A total of 106 soil samples taken in Duhok governorate for analyzing heavy metals to investigate the soil contamination and the ecological effect. Contamination factor (*Cf*), degree of contamination (DC), ecological risk factor (Er) and potential ecological risk index (PERI) were used to determine the contamination status and ecological risk. Fourteen heavy metals were analyzed including Aluminum, Arsenic, Barium, Chromium, Copper, Iron, Lead, Lithium, Manganese, Nickel, Phosphorus, Strontium, Vanadium, Zinc. All samples include heavy metals which are under permissible limit. Al concentration ranges between (11100 to 50000 mg/kg), Arsenic (0.84 - 13.7 mg/kg), Barium (25.1 - 2030 mg/kg), Chromium (34.5 – 318 mg/kg), Copper (10.9 – 68.1 mg/kg), Iron (14700 – 54800 mg/kg), Lead (1.2 – 131 mg/kg), Lithium (23.1 – 110 mg/kg), Manganese (344 – 1070 mg/kg), Nickel (45.6 – 474 mg/kg), Phosphorus (104 – 856 mg/kg), Strontium (29.2 – 369 mg/kg, Vanadium (29.9 – 120 mg/kg), and Zinc (15.4 – 344 mg/kg). C*f* for all samples are 1.0 mg/kg according to, which mean Low contamination (Indicates minimal pollution) except 6 sample ranges between 1.0 – 3.0 mg/kg, meaning moderate contamination. DC for all heavy metals are < 8.0 mg/kg meaning

Low degree of contamination except 5 samples ranges between 8.0 to 16 mg/kg means Moderate degree of contamination. Er for all samples are < 40 mg/kg meaning Low ecological risk except 6 samples ranges between 40 to 80 mg/kg meaning Moderate ecological risk. PERI for all samples are < 150 mg/kg which falls in Low risk category.

Keywords: Heavy metal in Soil, Contamination Factor, Ecological risk Assessment, Duhok-KRI

Drill Cutting Soil treatment by UV and H2O2

Zhakaw kamal Abdullah[1] **and Dalshad Azeez Darwesh**[1]

[1]*Environmental Sciences and Health Department, College of Science, Salahaddin University-Erbil, Kurdistan Region, Iraq*

Abstract

This study was carried out for remediation of drill cutting soil in two oil field sites in Kurdistan Region of Iraq. Two remediation technologies such as H2O2 and UV radiation were implemented. Heavy metal (Pb, Cd, Cr, Ni) and physical, chemical parameter (pH, EC, O.M, CaCO3, Chloride) were analyzed before and after remediation for cutting soil. The experiments were designed in Factorial CRD. The result indicate that the concentration of heavy metal (Ni, Cd and Cr) were within the normal range except the concentration of Pb). The result showed that the removal rate of heavy metal for UV exposure was (Pb%20.53, Ni%42.17, Cd% 61.53, Cr59.33).while the removal rates of heavy metal for H2O2 technology were ((%20Pb, %15Ni, %67Cd and %51Cr). this means that UV radiation more effective.

Keywords: drill cutting, heavy metal, H2O2, UV radiation

Analysis of Dust Storms in Erbil City-IRAQ Using Surface Observations and GIS Techniques

Rebin Samad Abdullah[1]

[1]Department of Surveying ,Erbil Technology College ,Erbil Polytechnic University, Erbil, Krg. Iraq rebin.abdullah@epu.edu.iq

Abstract

Dust storms are a common phenomenon in desert and semi-desert areas, they arise when the wind blows and has the ability to soil grains transfer particles from the Earth's surface and carry them over distances determined by the wind speed and the size of the particles, when this occurs Winds with a speed between (7-8) of per second and at a height of one meter have the ability to can erode soil and transport it over long distances through wind erosion. Although Erbil is geographically distant from many foreign regions, it is still affected by global environmental changes, like most other parts of the world. For example, Erbil experiences the phenomenon of dust storms, to measure the amount of dust in Erbil, a special device measuring 1meter in length and 1 meter in width, equipped with glass, was used to collect dust particles. Physical analysis of the dust was conducted every 12 months in 2024. according to the results, the highest amount of dust recorded in Erbil was 3.5 grams in September, while the lowest amount, recorded in May 2024, was 1.2 grams , for the comparison and analysis of the resulting data, a geographic information system (GIS) is used. This system helps create various maps and conduct data analysis in Erbil city.

Keywords: Erbil, GIS, Dust Storm, Wind, Data

Boosting Performance: A study on Caffeine and Energy Drink consumption Among University Studies

Jwamer H.[1], Aram A.[1], Dahat M.[1], Laween S.[1], Aya Q.[1] and Diyar S. Ali[2,*]

1 Department of Pharmacy, College of Pharmacy, Knowledge University, Erbil, Kurdistan Region, Iraq

2 Department of Chemistry, College of Science, Salahaddin University-Erbil, Erbil, Kurdistan Region, Iraq

* diyar.ali@su.edu.krd

Abstract

Energy drink consumption and caffeine intake have nowadays remarkably increased among students at universities, raising major concerns about potential health effects and implications for academic performance. This research sought to assess the pattern of consumption, motives, and health awareness about energy drinks and caffeine use among pharmacy students during the academic year 2024-2025 at Knowledge University.

The study design was cross-sectional, in which the online questionnaire was forwarded to 103 students of pharmacy. The data on consumption pattern, motives, and self-reported health effects were collected using the survey tool. Analysis included the use of descriptive statistics, SPSS, and chi-square tests for exploring the associations between variables.

A total of 35% of participants reported daily caffeine consumption, whereas 18.4% indicated they consumed energy drinks on a daily basis. The main reasons identified were the need to remain alert (27.5%) and the establishment of habitual behaviour (23.5%). Most of the consumption took place in the morning, at 25.2%, and was especially prevalent during educational activities. A significant proportion, 47.6%, of respondents showed apprehension regarding health effects. Of the health effects, the most widespread side effects included sleep disturbance for 23.3% and

palpitations for 17.5% of the participants.

This study depicts important patterns in the strategic use of caffeine and energy drinks within academic pressures and underlines a great awareness of health risks among pharmacy students. These findings suggest a critical need for targeted interventions and health education programs within university settings. The present study sheds light on significant patterns in the strategic use of caffeine and energy drinks within the context of academic pressures but also demonstrates high awareness of health risks among pharmacy students. The findings suggest a critical need for targeted interventions and health education programs within university settings.

Keywords: Energy drink, caffeine, academic performance, health awareness.

Vegetable crop waste as an alternative and sustainable feed for ruminant: characterization, nutritional value and digestibility of individual and mixture waste

Ayeb N[1,2] Abdulqader A. Hussein [3], Jallali A1, Hajlaoui A[1,2], M Hammadi[2], T Khorchani[2]

Regional Center for Agricultural Research (CRRA), Gafsa Road km 6, Sidi Bouzid, 9100, Tunisia.

Laboratory of Livestock and Wildlife, Institute of Arid Lands (IRA), Elfje Road km 22, Medenine, 4119, university of Gabes, Tunisia.

Animal Resources Department, Agriculture Engendering Sciences, Salahaddin University-Erbil, Iraq

*Corresponding author: A.A. Hussein, E-mail: abdulqader.hussein@su.edu.krd, Present address: Animal Resources Department, Agriculture Engendering Sciences, Salahaddin University-Erbil, Iraq.

Abstract:

Reduction in the high cost of ruminant animal feeding as a result of the massive use of imported raw materials possess farmers to employ various adaptation strategies such as using of crop vegetable waste (CVW) in livestock feeding. The present study was carried out in the Sidi Bouzid region aims to evaluate the chemical composition and estimate the *in vitro* digestibility of different CVW samples taken from farmers in this region. The main chemical composition results showed that the average total nitrogen contents were superior in tomato, spinach, fennel and carrot (14.38; 14.34; 12.45 and 12.25% respectively). However, the highest value of this parameter was recorded in the mixture of fennel and lettuce (15.83 ± 0.35). Fibers content was ranged from 24.22% in squash to 50.76% in beans. The mixture of potato and tomato residues represented the highest fiber content (34.49 ± 0.4%). The highest dry matter digestibility was recorded in garlic cultivation, followed by beetroot and lettuce. However, the fennel and lettuce mixture was the most digestible by the animals (76.25 ± 0.14%). Vegetable waste on the farm or in vegetable markets are rich in nutrients and would reduce the cost of animal feed and contribute to waste management and reduction of environmental pollution.

Keywords: vegetable waste, alternative feed, ruminants, chemical omposition, in vitro digestibility.

Supranational Mechanisms for Cooperation in the Fertile Crescent: Water for Diplomacy and Regional Peace

Mukhtar Hashemi

[1] Chairman, Land and Water Policy Council, Water and Agriculture Commission of Sanandaj Chamber of Commerce, Industries, Mines and Agriculture, Kurdistan, Iran

Abstract

Our region faces huge challenges in dealing with water scarcity which has a great bearing on water and food security. To deal with this there is a need to consider water-food-energy nexus as a vital concept to streamline sectoral polices. The looming water and energy crisis cannot be solved by bilateral agreements or keeping the status quo. Thus, there is a need for supranational mechanisms for regional cooperation. Based on this notion, this keynote address initially deals with how to implement sustainable water policies by reassessing The Integrated Water Resources management (IWRM) concept and provide a framework for supranational policymaking in the fertile Crescent of Turkey, Iran, Iraq (including Kurdistan Region of Iraq) and Syria with reference to West Asia and North Africa (WANA) region. Given the complex nature of water scarcity in the WANA region which is characterised by its dynamic nature in terms of socio economic and political, climate, technological and resource availability changes, finding science–water policy interface is vital to enhance the policymaking process in the region. Next, (1) a methodological approach for supranational cooperation in the Fertile Crescent: water for diplomacy and peace; and (2) an institutional design for the creation of regional water governance are provided. Given the complexity of the disputed water issues among the riparian countries represents a major challenge in the sustainable development and utilization of the shared water resources in a fair and equitable manner. The proposed Regional Water Council can be an honest broker to find a common platform for confidence building, and promote supranational water policies, and solutions. Finally, using region's cultural heritage as an entry point, new home born concepts such as Hima (محی) can be used as a basis for work on environmental protection of Kurdistan Region and the wider Iraq and WANA region. Hima is defined as a Community Based local land

and water Resources Management System that promotes; Sustainable Livelihood, Resources Conservation, and Environmental Protection; for the Human wellbeing; i.e. Hima concept provides a coherent set of principles for an equitable and sustainable use and management land and water. Additionally, it is argued that there is a need for an integrated research policy on a regional scale. A dialogue within the research communities in the region is essential to enhance communications and to remove institutional barriers. This will create a platform for a wider dialogue among policy makers, the scientific community and the public at large. Researchers can become facilitators in difficult public policy debates and create a foundation for participatory decision making processes. A Regional Scientists Water Network can play a major role to make the countries in the region recognize that water has to be considered basic human rights issue and streamlined national polices have to consider that people are entitled to sustainable water and sanitation services.

Keywords: Integrated Water Resources management (IWRM), Hima concept, environmental protection, supranational mechanisms, water for diplomacy and peace, water-food-energy nexus, integrated research policy, the Fertile Crescent, Kurdistan Region of Iraq

Estimating the Effect of Urban Growth on Curve Number Using GIS in the Erbil Sub-Basin of the Kurdistan Region of Iraq

Arkan H. Ibrahim[1] **Pshtiwan Othman Zaid**[2] **Abdulla Abdulwahid Abo**[3]

Arkan.ibrahim@su.edu.krd[1] Pshtiwan.zaid@su.edu.krd[2] Abdulla.abo@su.edu.krd[3]

[1,2,3]Department of Water Resources Engineering, College of Engineering, Salahaddin University- Erbil, Erbil, Kurdistan Region, Iraq.

Abstract

The urban development of areas directly affects hydrological processes by changing patterns of surface runoff. Cities growing experience increased flood risks as natural water absorption is reduced by changing permeable ground with structures non-absorbent. The research analyzes how expansion of urban between 2017 and 2023 influenced the Curve Number (CN) in the Erbil Sub-Basin using (GIS). This study stands differ from earlier research by focusing solely on how LULC changes affect CN values without considering precipitation data. The study achieves a more precise understanding of urbanization impacts on hydrological responses through its precipitation-independent methodology. This research methodology utilizes high-resolution satellite imagery along with soil classification maps and digital elevation models (DEMs) to determine transformations in land use and land cover (LULC). This study uses the Soil Conservation Service Curve Number (SCS-CN) method to analyze runoff changes caused by urban development. CN values steadily grew from 80.53 in 2017 to 81.50 in 2023 as agricultural and barren lands transformed into urbanized spaces. The growing trend points to an increased risk of urban flooding while decreasing groundwater recharge which makes it essential to develop sustainable water management practices. This research advances urban hydrology studies by showing how CN-based modeling helps assess hydrological changes from urban development. The study findings show that green infrastructure and permeable surfaces with stormwater management techniques are essential to lessen the negative impacts of accelerated land development. Future studies need to combine hydrological modeling with real-time monitoring and climate adaptation plans to develop better predictive tools and strengthen urban flood defense systems.

Keywords: GIS, Hydrology, CN, LULC, Urban grouth, Runoff.

دراسة واقع حال الاراضي المتدهورة اثر التملح والتغدق الاسباب – الحلول والمعالجات - الطموح

د. هادي هاشم حسين / وزارة الزراعة - مدير عام دائرة البستنة
د. راوية مزعل محمود / وزارة الزراعة - معاون مدير عام – دائرة الارشاد والتدريب الزراعي
د. وليد محمد مخلف / وزارة الزراعة – دائرة التخطيط والمتابعة – مدير قسم الخرائط البيئية الزراعية قيس عواد عمر / استشاري – دائرة الغابات ومكافحة التصحر

المخلص:

أختير السهل الرسوبي وسط وجنوب العراق لتأثره بتملح التربة وبدرجات متباينة وبتنوعه الجيومورفولوجي والفيزيوغرافي فضلا عن تغايرات مهمة في ظروف التربة لحصول عمليات جيولوجية وبيدولوجية متعددة أدت الى ان تكون اراضيه متاثره بمظاهر التدهور المختلفة نتيجة ظروف بيئية معقدة ومن ضمنها الملوحة. استخدمت الادلة الطيفية المستنبطة من الصور الفضائية فضلا عن المؤشرات الموقعية المأخوذة من البحوث والدراسات السابقة مثل دليل الاختلاف للغطاء الخضري الطبيعي (NDVI) وخارطة استخدامات الارض/الغطاء الارضي (LU/LC) والبيانات المناخية ونماذج التربة المستحصلة من منطقة الدراسة اثناء الدراسة فضلا عن المعلومات والبيانات والخرائط الرقمية لدراسات سابقة تخص الموضوع لتحديد التوزيع المكاني للترب المتأثرة بالاملاح ومساحاتها واسباب التملح الطبيعية وتلك الناتجة عن تدخل الانسان ومدى تاثر الانتاج الزراعي بهذه الظاهرة ووضع التوصيات واقتراح عدد من الحلول قريبة وبعيدة المدى. بهدف تقليل الكلفة والوقت والجهد وزيادة كفاءة العمل فقد استخدمت البرامج الحاسوبية الحديثة مثل مع النتائج هذه وبمطابقة MS Excel. وبرنامج Google Earth Engine ومنصة ArcGIS x.١٠ جداول ملائمة عدد من المحاصيل الزراعية لمديات مختلفة من ملوحة التربة يتضح بان مساحات مهمة من اراضي السهل الرسوبي متباينة الملائمة لزراعة وانتاج عدد من المحاصيل الستراتيجية في الظروف الحالية وتحت الممارسات الزراعية التقليدية المتبعة من اغلب مستخدمي الاراضي الزراعية نتيجة عامل الملوحة الاكثر تحديدا للانتاج الزراعي في هذا الجزء من العراق نتيجة التأثيرات المباشرة وغير المباشرة على النبات. على الرغم من ان انتشار الترب المتأثرة بالملوحة واسع النطاق في العراق خصوصا في السهل الرسوبي، لم تجر دراسة شاملة لتقييم الوضع الا محاولات محدودة ولم تكن هناك شبكات لتقييم ورصد التغايرات في ملوحة التربة لذا فأن تحديد اثرها والمشاكل البيئية الناجمة عنها يؤثر سلبا في دقة القرارات القريبة المدى والاستراتيجية المتخذة بشأنها. ونظرا لتعقيد وحجم المشكلة ستكون التقانات الجيومكانية بالتكامل مع الاحصاءات المكانية في نمذجة واسعة النطاق للتنبؤ بالتوزيع المكاني للترب المتأثرة بالاملاح فضلا عن توزيع الانماط النباتية تبعا لخصائص الارش والمناخ.

Environmental Drivers of Landmine Displacement in the Iraqi Kurdistan Region: An AHP Approach for Risk Mapping and Prioritization for Mine Clearance

Huner A. Khayyat [1], Kaiwan K. Fatah [2], Diana Contreras [3], Ross Colwell [4]

[2] Department of Earth Sciences and Petroleum, College of Science, Salahaddin University-Erbil Kurdistan Region of Iraq, (kaiwan.fatah@su.edu.krd),

[1] Department of Geography, College of Arts, Salahaddin University-Erbil, Kurdistan Region of Iraq (huner.khayyat@su.edu.krd)

[3] School of Earth and Environmental Sciences, Cardiff University, United Kingdom (contrerasmojicad@cardiff.ac.uk)

[4] Global Mine Action IM Advisor, Manchester, United Kingdom (ross_colwell1@hotmail.co.uk)

corresponding author kaiwan.fatah@su.edu.krd

Abstract

Iraq ranks as one of the most contaminated nations globally by Explosive Ordnance (EO), with the Kurdistan Region being especially affected due to the Iraq-Iran war and Kurdish uprisings. This contamination triggers significant threats, resulting in numerous fatalities and injuries.

This research aims to delineate vulnerable mountain areas in the Kurdistan Region of Iraq that are susceptible to landmine migration by applying a comparative analysis using the Geoinformatics-based Analytical Hierarchy Process (AHP). The AHP methodology evaluated the relative importance of eleven causative factors influencing landmine migration. These factors include distance to streams, drainage density, distance to roads, proximity to existing landmines, lithology, slope, geomorphology, rainfall, Terrain Ruggedness Index (TRI), distance to the vertex of the base of the channel, and curvature. The AHP modeling results identified the distance to streams as the most significant factor, with a weight of 19.79%, highlighting its substantial role in determining areas prone to landmine migration. The study area, spanning 888.18 km², was categorized into various landmine susceptibility zones, ranging from very low to very high. Notably, approximately 40.58% (360.45 km²)

of the total area was identified as high to very high susceptibility regions, indicating critical zones that require urgent intervention for demining and risk mitigation. The model's predictive accuracy was assessed using the Area Under the Curve (AUC) from the Receiver Operating Characteristic (ROC) analysis, yielding an AUC value of 0.861, reflecting high predictive accuracy. These findings underscore the efficacy of integrating GIS and AHP for assessing landmine migration risks, providing valuable insights for landmine risk management, and facilitating more targeted demining efforts in the mountainous regions of Iraq.

التغير المناخي والسياسات الزراعية في العراق: تحديات وآفاق تعزيز الأمن الغذائي

م. د غفران جعفر اسماعيل[1] ا.م.د.ناديه طلعت سعيد[2]

[1]جامعة بغداد- كلية التربية ابن الرشد ghofran.i@ircoedu.uobaghdad.edu.iq

[2]جامعة صلاح الدين -أربيل –كلية الاداب nadia.saeed@su.edu.krd

الملخص:

يهدف هذا البحث إلى تحليل السياسات الزراعية في العراق ودورها في تحقيق الأمن الغذائي في ظل التحديات البيئية والاقتصادية. يعاني القطاع الزراعي من تراجع الإنتاجية بسبب ندرة الموارد المائية، تدهور الأراضي، وضعف البنى التحتية الزراعية، مما يعكس الحاجة إلى تبني استراتيجيات زراعية حديثة ومستدامة. تعتمد الدراسة على المنهج الوصفي التحليلي، حيث تم جمع البيانات من تقارير رسمية، ودراسات أكاديمية، ومقابلات مع خبراء في مجالات الزراعة والإدارة البيئية.

أظهرت النتائج أن السياسات الزراعية الحالية لا تتماشى بشكل كافٍ مع متطلبات الاستدامة، حيث تفتقر إلى خطط واضحة لإدارة الموارد المائية وتحسين جودة التربة، فضلاً عن غياب دعم المزارعين لاعتماد تقنيات زراعية مقاومة للظروف البيئية المتغيرة. كما أن الاستثمار في الزراعة الذكية وتعزيز الشراكات بين القطاعين العام والخاص لا يزال محدودًا، مما يعيق تحقيق الأمن الغذائي.

يوصي البحث بضرورة تطوير إطار سياسي متكامل يركز على تحديث نظم الري، وتحفيز الاستثمارات في التقنيات الزراعية المتقدمة، ودعم الأبحاث المتعلقة بالزراعة المستدامة. كما يشدد على أهمية الاستفادة من التجارب الدولية الناجحة في إدارة الموارد الزراعية وتعزيز مرونة القطاع الزراعي في مواجهة التحديات البيئية.

الكلمات المفتاحية: السياسات الزراعية، الأمن الغذائي، الاستدامة، الموارد المائية، العراق.

Hydromorphological characteristics and the impact of climate change mathematical simulation

by Support Vector Machines Algorithm (SVM) for Valley of the Marj Basin, an applied study

Dr. Ali Suleiman Erzik Al Karbouli
General Directorate of Anbar Education
alisu8720@gmail.com

Dr. Ahmed Ayada Khud
air Iraqi University – Faculty of Arts
ahmed.al-hadeethi@aliraqia.edu.iq

Dr. Nadia Talaat Saeed
Salahuddin University - Faculty of Arts
Nadia.saeed@su.edu.krd

Abstract:

The phenomenon of climate change has become a reality that the international community has to deal with seriously, and climate change is distinguished from most other environmental issues by its global nature, but its local effects are more severe. Studies have shown that there is an increase in surface air temperatures on the globe as a whole by about (0.7

during the past 100 years, and studies by the Intergovernmental Panel on Climate Change (IPCC) indicated that this continuous rise in the global average temperature will lead to many serious issues such as drought, desertification and change in all current landforms, and to show the impact of changes.

Does climate change have an impact on the nature of the water network in Wadi al-Marj and its impact on the water network, the water revenue of the basin, the quantities of that water, the nature of its distribution, the amount of losses, and the extent of the impact on soil characteristics and quality?

Climate change has a significant impact on the hydromorphological characteristics, as it affects the water network and the nature of its longitudinal extension, especially since the research area is characterised by its low slope compared to the nature of the extension, as well as the impact of the climate with its various elements and the lack of water runoff in dry seasons, which leaves a clear impact on the chemical characteristics of the soil and the nature of its composition, whether it is calcareous or gypsum, as well as the extent of its organic matter content .

The researchers aim to identify the impact of climate changes expected to occur by 2050 on the natural, morphological, and quantitative characteristics of the Wadi Al Marj basin, to build a geographic database containing morphometric variables and other variables related to the nature and characteristics of soils, as this database is characterised by the accuracy of its details that are not provided by topographic maps, due to the importance of these characteristics in hydrological and eomorphological studies.

The area of Wadi Al-Marj basin is (2062.33 km2) and is located in a region characterised by a dry climate for most months of the year except for some short rainy periods that provide good water discharges that can be exploited for water harvesting purposes, Wadi Al-Marj extends over a plateau surface varying in height between (57 m) at the mouth and (380

The research showed that the drainage network of the basin is of the sixth order and the drainage density and river frequency are high due to the high permeability of rock formations .

While the results of the special algorithm in analysing the impact of climate change on the studied characteristics by 2050 showed that by 2050 temperatures will increase by 2-3 m by 2050, which means increased evaporation rates, and as for rainfall, it is expected that rainfall will decrease by 10%. This will lead to a decrease in the amount of water available for agriculture and human use and an increase in soil salinisation due to a decrease in the natural washing of salts. As for the soil, its salinity will increase due to decreased rainfall and increased evaporation, especially the calcareous and gypsum desert soils and will be vulnerable to degradation and erosion due to the lack of vegetation cover, which will decrease by 20-30% due to drought and increased heat. As for running water, it is expected

that the amount of running water will decrease by 15-25% due to reduced rainfall and increased evaporation, and this will lead to changing the paths of watercourses due to the reduced amount of water, resulting in changing the landforms caused by water erosion.

Keywords: Clemate Change, Sum, Hydromorphology

Spatiotemporal Evaluation of Rainfall Variability and Drought Patterns and its Impact in Sulaymaniyah Province (1981–2023) based on CHIRPS data and meteorological indices.

Halaw H. Kareem[1], Huner A. Khayyat[1], Heman A. Gaznayee[2], Tahseen A. Aziz[1], Mattia Creespi[3]

1. Salahaddin University-Erbil, College of Arts – Department of Geography.
2. Salahaddin University-Erbil, College of Agricultural Engineering Sciences.
3. University of Rome – La Sapienza, Geodesy and Geomatics Division - DICEA

Abstract

Drought is one of the most important natural hazards faced by many countries worldwide. It affects many societies and causes significant economic and environmental losses, as well as social difficulties. It is one of the most serious climatic disasters and significantly affects water resources, agriculture, plants, the environment, and human health. The datasets such as CHIRPS (Climate Hazards Group Infrared Precipitation with Station Data) provide high-resolution (0.05°) rainfall estimates and used long- term rainfall records suitable for trend analysis and seasonal drought monitoring. This study aims to analyze the spatial and temporal variations in rainfall within Sulaymaniyah Governorate from 1981 to 2023 and assess drought trends during this period. The research utilizes data from 22 climatic stations distributed across the region, covering 504 months of rainfall records obtained from the Climate Hazards Center (CHIRPS). The dataset was processed in raster file formats, from which tabular data for the selected stations were extracted and analyzed. Additionally, CRU TS (Climatic Research Unit gridded Time Series) data were employed to obtain monthly temperature values necessary for calculating Potential Evapotranspiration (PET) using the Thornthwaite method.

To characterize rainfall patterns, various statistical indicators were applied, including the coefficient of variation, run test, Precipitation Concentration Index (PCI), Seasonality Index (SI), Standardized Precipitation Index (SPI), and the Reconnaissance Drought Index (RDI). The findings of this research

contribute to a deeper understanding of precipitation variability and drought occurrence in Sulaymaniyah Governorate, providing valuable insights for climate adaptation planning, agricultural management, and water resource strategies.

The study's findings indicated significant declines in rainfall levels in the Sulaymaniyah Governorate during the analyzed years. Between 1980 and 2001, the average rainfall was 657.9 mm, however, from 2001 to 2023, it decreased to 607.02 mm, reflecting a change rate of -7.7%. The region is categorized as having medium variability, with an average coefficient of variation of 22.85%, based on the analysis of annual rainfall variability. The statistical (Run) test demonstrates that annual variations in total rainfall exhibit a random pattern without a significant trend. The percentage of seasons with below-average rainfall increased from 33.3% in the initial period to 50% in the subsequent period, representing a 57% escalation, indicating a worsening trend in rainfall reduction occurrences.

The (Run) test results indicate that the annual variations in total rainfall within the study area are statistically random and do not exhibit a discernible pattern over the study period. The P Value for all examined stations exceeds the threshold of 0.05 for null hypothesis rejection, thus we cannot dismiss the null hypothesis, which asserts that the annual total rainfall over the analyzed time series is random and lacks a discernible trend. This signifies the inherent fluctuation of yearly precipitation.

Analysis of the Monthly Precipitation Concentration Index (PCI) across the selected 19 stations during the 43 examined rainy seasons, as detailed in Table 3, reveals that the category (PCI<10), signifying a uniform distribution of monthly rainfall, was absent at all studied stations throughout the study period.

The recurrence of the majority of rainy seasons is classified within the range (16<PCI<20), signifying an uneven distribution and concentration of monthly precipitation. The recurrence rate of rainy seasons in this category averages 62.55% across all stations, in contrast to 20.44% for seasons classified within the range of 10<PCI<16, indicating a moderate concentration of rainfall. Moreover, 16.89% of the rainy seasons are classified as (PCI>20), indicating a significant concentration of precipitation during particular months. Seventy-

nine-point one percent of the rainy seasons across all stations exhibit an irregular distribution of precipitation, concentrated during a limited number of months, indicative of the region's rainfall seasonality.

Statistics indicate that 65.55% of rainy seasons exhibit varied precipitation distribution and concentration during specific months. The Standardized Precipitation Index (SPI) indicated that the study identified five distinct periods of drought. The 2007–2008 season was the driest, with values surpassing (-2) at all locations. The average values of this indicator shifted from positive in the initial period to negative in the subsequent period, indicating an increase in drought events. The trend line indicated a significant decline in index values across all stations, whereas the exploratory drought index confirmed a rising trend in both the intensity and duration of drought occurrences.

The average initial value of the Reconnaissance Drought Index (RDI) for the examined stations over the research period was 2.29. The spatial variance of drought, as indicated by the Reconnaissance Drought Index (RDI), escalates in the southern regions and diminishes in the northern parts.

The average value of the drought index for (UNEP) in the study area was (0.61), thus the area is generally classified as having a semi-arid climate.

According to the Precipitation Deciles (PD) index, there are ten rainy seasons rated (1-2) that are significantly below the average for the research period, representing 23.26% of the total wet seasons.

The integration of high-resolution CHIRPS and CRU TS datasets enhances the accuracy of drought assessments, making this study a significant reference for policymakers and researchers working in climate risk management and sustainable development.

Keywords: Drought, Climate change, Rainfall variability, CHIRPS datasets, and Precipitation trends.

Hydrogeological Characterization of Qushtapa and Shamamik Area in Erbil Basin, using Pumping Test Data

Seber M. M. Ameen[1,2] Rebwar N. Dara[2,3]

[1]General Directorate of Divan, Ministry of Agriculture and Water Resources, Erbil, Kurdistan Region, Iraq

[2]Department of Earth Sciences and Petroleum, College of Science-Salahaddin University - Erbil, Kurdistan Region, Erbil, Iraq

[3]Department of Petroleum Engineering, College of Engineering, Knowledge University, Erbil, Iraq

Corresponding Author E-mail: sebarameen@gmail.com

Abstract

This study investigates the hydrogeological parameters through detailed pumping test analysis in the Qushtapa and Shamamik areas within the Erbil Basin. This study aims to assess key aquifer parameters, including hydraulic conductivity, transmissivity, and storage coefficient, which are substantial for sustainable groundwater management. Data from 10 groundwater pumping tests were analyzed using established analytical approaches, such as the Cooper-Jacob straight-line method, and Theis recovery method using AQTESOLV and Microsoft Excel program to derive hydrogeological parameters of the aquifer. The results show significant spatial variability in aquifer properties impacted by lithological variability and the rate of groundwater recharges. In Qushtapa the average hydraulic conductivity ranges between 0.029 m/day and 0.191m/day with a mean value of 0.105 m/day. The average Transmissivity value ranges between 8.54 m2/day and 47.7 m2/day with a mean value of 29.6 m2/day. The Storage Coefficient ranges between 0.071 and 0.323 with a mean value of 0.21. In the Shamamik area, the hydraulic conductivity ranges between 0.0245 m/day and 0.0415 m/day with a mean value of 0.033 m/day. The average value of Transmissivity ranges between 9.445 m2/day and 11.535 m2/day with a mean value of 10.6 m2/day. The storage coefficient ranges between 0.081 and 0.312 with a mean value of 0.19. Based on the Kresny (1993) classification for Transmissivity the studied area is classified as an area with Low-Intermediate class of Transmissivity. Pumping tests play a crucial role in ensuring long-term water security and informing sustainable development policies in the study area. average value of Transmissivity ranges between 9.445 m2 /day and 11.535 m2 /day with

a mean value of 10.6 m2 /day. The storage coefficient ranges between 0.081 and 0.312 with a mean value of 0.19. Based on the Kresny (1993) classification for Transmissivity the studied area is classified as an area with Low-Intermediate class of Transmissivity. Pumping tests play a crucial role in ensuring long-term water security and informing sustainable development policies in the study area.

Keywords: Climate Change, SVM, Hydromorphology.

Spatiotemporal Analysis of Groundwater Level Decline in Qushtapa and Shamamik Area in Erbil Basin, Kurdistan Region

Seber M. M. Ameen[1,2] Rebwar N. Dara[2,3]

[1]General Directorate of Divan, Ministry of Agriculture and Water Resources, Erbil, Kurdistan Region, Iraq
[2]Department of Earth Sciences and Petroleum, College of Science-Salahaddin University - Erbil, Kurdistan Region, Erbil, Iraq
[3]Department of Petroleum Engineering, College of Engineering, Knowledge University, Erbil, Iraq
Corresponding Author E-mail: sebarameen@gmail.com

Abstract

Groundwater is the most valuable fresh resource. Uncontrolled extraction and unregulated activities besides global climate change have contributed to the depletion of groundwater resources in the Erbil Basin, Kurdistan Region. This research aims to illustrate groundwater levels in Qushtapa and Shamamik areas to highlight the significant disparity in groundwater levels over the past 20 years. The data from 20 monitoring wells were recorded and mapped using the IDW spatial interpolation method. The result of fitted data shows the maximum groundwater level declination in the Qushtapa area during 2005-2024 is about 102.5 m above sea level in the Qushtapa well, in the center of district. The minimum declination is 30.2 m above sea level for, namely, Azyana well. In Shamamik, the maximum declination is 99.6 m in the Pirdawd well, and the minimum declination is

58.1 m above sea level in the Tandura well. The interpolated maps show that the intensive declination started in 2015 and became more intensive by 2024. The area that faces the stress is the center of the Qushtapa area, while northwest of Shamamik and northeast of Qushtapa are less affected. These findings can provide a valuable indication for a better understanding of the need for better water management and enable decision-makers to devise optimal solutions for this resource's sustainability. The launching strategic Qushtapa Water Project which is implemented by KRG will contribute to preventing the exploitation of the resource in the area.

Keywords: Grandwater, Spatiotemporal Shamamik, KRG.

Assessment of Surface and Groundwater Quality of the Alana River Basin: Using an Integrated Physical, Chemical and Biological Approach

Shena Kawa Abdullah[1] Rebwar N. Dara[1,2]

[1]Department of Earth Sciences and Petroleum, College of Science-Salahaddin University - Erbil, Kurdistan Region, Erbil, Iraq
[2]Department of Petroleum Engineering, College of Engineering, Knowledge University, Erbil, Iraq
Corresponding Author E-mail: **shena.k94@gmail.com**

Abstract

The hydrochemical and biological assessment of the Alana River Basin is crucial to guaranteeing the safety of surface and groundwater for drinking, industry, and agriculture suitability. The overarching goal in this study is to evaluate the water quality parameters in the basin through different sources, such as surface and groundwater, through an evaluation of the biological, chemical, and physical characteristics of the water while considering various factors that influence it. We collected 15 surface water and 3 groundwater samples from the Alana Basin until the joining of the Bekhal, Balakian, and Khalifan Rivers for dry seasons (October 2024). The evaluated microbiological parameters were total coliforms, thermotolerant bacteria, and E. coli. The results of this study show that all surface and groundwater samples conformed to the acceptable limits set by comparison with WHO and IQS, based on chemical and physical criteria. The quality assessment for rinking water revealed that all surface water samples exhibited from good to excellent quality, along with an excellent quality of all groundwater samples. Additionally, the suitability of water according to TDS and T.H. suggested that water samples were harsh freshwater. Surface water and groundwater are classified as Ca- bicarbonate according to Piper and Chadha diagrams. Microbiological indicators revealed that all surface and groundwater samples collected during dry seasons did not comply with WHO guidelines, hence proving their contamination. Consequently, the water in this basin is unfit for direct consumption and necessitates treatment before use. The combination of chemical, biological, and physical value gives insight into the best practice of water resource management for the Alana River basin management.

Keyword: Surface water, Groundwater, Biological, Physical, Quality.

Evaluating Alternatives to Bekhma Dam: Integrated Water Resources Management for Sustainable Development in the Greater Zab Basin

Arkan H. Ibrahim[1] Abdulla A. A.[2]

[1,2,]Department of Water Resources Engineering, College of Engineering, Salahaddin UniversityErbil, Erbil, Kurdistan Region, Iraq.

[1,]Department of Civil Engineering, College of Engineering, Salahaddin UniversityErbil, Erbil, Kurdistan Region, Iraq.

Abstract

Climate changeability along with urban development and higher water requirements produce serious water security problems for the Kurdistan Region of Iraq (KRG). The Greater Zab River purposes as a vital water source for the region as a primary branch of the Tigris River yet faces serious challenges in preserving sustainable resource management. This study conducts an assessment of the Bekhma Dam which was initially designed to serve as a key solution for water scarcity alongside hydropower generation and flood control. The proposed dam's construction has challenged several complications which involve environmental concerns, economic constraints and geopolitical conflicts.

The research conducted with Geographic Information System (GIS) and Digital Elevation Models (DEM) which examines four possible dam sites within the Greater Zab Basin. The research team assessed four alternative dam locations based on their storage capacity along with their environmental impacts and economic feasibility while ensuring agreement with Integrated Water Resources Management (IWRM) principles. The study specifies that strategically placed alternative dams present other options for resolving water management challenges in the region. The environmental and social impacts typical of large-scale projects such as Bekhma might be reduced through the use of smaller dams which retain essential water storage and flood control functions.

The research highlights the critical need for comprehensive water management strategies across the Greater Zab Basin. The research demonstrations that smaller decentralized storage facilities improve regional

water security while determining urgent environmental and economic issues. To accomplish sustainable implementation of these alternatives future research must concentrate on detailed feasibility studies and sediment management as well as stakeholder engagement.

Keywords: GIS, IWRM, Bekhma Dam, Greater Zab, Water Scarcity

التحليل الجغرافي لاتجاهات الأمطار الفصلية و الموسمية في مدينة أربيل (1940-2024)

الاستاذ الدكتور سليمان عبدالله اسماعيل[1]
[1]جامعة صلاح الدين/ اربيل
كلية الاداب- قسم الجغرافية

الملخص

تعتبر دراسة اتجاهات الأمطار من القضايا الحيوية لفهم التغيرات المناخية. تهدف هذه الدراسة إلى تحليل التغيرات في أنماط الأمطار الشهرية والفصلية والموسمية في مدينة أربيل خلال الفترة من عام 1940 إلى 2024 مستندة إلى بيانات طويلة الأمد تم جمعها من محطة الأرصاد الجوية في أربيل. تم استخدام مجموعة من الأساليب الإحصائية المتقدمة، للكشف عن التغيرات الزمنية في كميات الأمطار، بالإضافة إلى دراسة التباين في مواعيد بدء وانتهاء المواسم المطرية.

أظهرت النتائج وجود تغيرات ملحوظة في توقيت بدء ونهاية موسم الأمطار، حيث لوحظ تأخر أو تقدم في مواعيد الهطول المطري في العديد من السنوات، مما يدل على اضطرابات واضحة في النمط المناخي السائد في المنطقة. كما كشفت التحليلات عن اتجاه عام نحو انخفاض كميات الأمطار الفصلية والموسمية، مع تسجيل تفاوت كبير بين الفصول الثلاثة: الخريف، الشتاء، والربيع. وأظهرت الدراسة أن فصل الشتاء لا يزال يسجل أعلى نسبة من الهطولات المطرية، إلا أن التذبذب في كميات الأمطار خلال الفترات القريبة الماضيه أصبح أكثر وضوحًا، مما قد يؤثر سلبًا على وفرة المياه السطحية والجوفية في المنطقة.

عند تحليل بيانات التساقط، أظهرت نتائج اختبار مان-كيندال وجود اتجاه هبوطي معنوي في كميات الأمطار خلال العقود الأخيرة، مما يعكس تأثير العوامل المناخية على نظام الهطول. كما أظهرت نتائج الانحدار الخطي أن معدل التغير في كميات الأمطار يتجه نحو الانخفاض بمعدلات متفاوتة بين الفصول، مما يشير إلى تغيرات محتملة في ديناميكية الغلاف الجوي المؤثرة على المنطقة.

ترتبط هذه التغيرات بعدة عوامل، منها التغيرات في أنظمة الضغط الجوي و النظام المتحكم في التساقط والتأثير المتزايد للتغير المناخي العالمي. وقد أسهمت هذه العوامل مجتمعة في زعزعة استقرار النمط المطري في إقليم كوردستان العراق عموما و منطقة سهل اربيل خصوصا.

استنادًا إلى هذه النتائج، توصي الدراسة بضرورة اتخاذ إجراءات تكيفية للتعامل مع هذه التغيرات، مثل تطوير أنظمة حصاد المياه، وتحسين استراتيجيات الري، وتعزيز الدراسات المستقبلية لمراقبة التغيرات المناخية بشكل أكثر تفصيلًا. كما يُوصى بإجراء دراسات إضافية حول تأثير التغير المناخي على التوزيع المكاني والزماني للأمطار في عموم العراق، مما يسهم في وضع سياسات بيئية مستدامة لمواجهة التحديات المناخية المتزايدة.

الكلمات المفتاحية: الامتار، التحليل الجغرافي، اربيل

Vascular Plants of HAWRAMAN Mountain (Sulaimani district, Kurdistan Iraq) in Kurdistan Iraq

Saman A. Ahmad[1]

[1]University of Sulaimani, Iraq. -Saman Abdolrahman Ahmad, College of Agriculture Engineering Sciences, University of Sulaimani, Iraq & Kurdistan Botanical Foundation, Sulaimani, Kirkuk Main Road, The American University in Iraq, Sulaimani, Iraq.

Abstract

Hawraman area is one of the most important plant areas in Kurdistan Iraq, as well as in the Irano- Turanian region. It is located about 50 km east of Sulaimani City, and between latitudes 35°05'– 35º20'N and longitudes 45°53'–46°11'E. Its altitudes range from as low as 484 m near Darbandikhan Lake to 2,598 m, the highest peak known as Hanae Nawa north of Sargat Village. It is about 33 km long and about 30 km at its widest part and occupies in Kurdistan Iraq a total area about 660 km2.The present Study is based on a three-year (2011–2013) intensive field studies of the plants of Hawraman coupled, with extensive survey of the literature and examination of specimens in various herbaria inside and outside Iraq. All specimens collected during this study were identified, numbered, classified and deposited in the herbarium of the Faculty of Agricultural sciences, Sulaimani University (SUFA). During this study about 3,500 specimens were collected at 135 waypoints on 33 trips each of which lasted two to three days. In order to avoid repetition and confusion during data collection, each species is given a unique number of a continuous series. For each collection number, coordinates (longitude and latitude), altitude, date, exact locality, and ecological information were recorded. After collecting at each waypoint, photographic plant profiles were made for most species in that area. This study covers a total of 1084 taxa, of which 951 were collected during the three-year fieldwork. This investigation covered all vascular plants of Hawraman, including those collected by earlier botanists.

Information about duration, frequency in the field, and reproductive status were recorded. This study adds 15 families and 426 taxa as new to the Hawraman area checklist and four species new to science: Ferula shehbaziana (Apiaceae), Onosma hawramanensis (Boraginaceae), Petrorhagia sarbagiae (Caryophyllaceae), and Scrophularia sulaimanica (Scrophulariaceae). The study also adds the following 19 species as new to the flora of Iraq: Apiaceae (Heracleum persicum), (Trigonosciadium brachytaenium), Araceae (Arum dioscoridis), Asteraceae (Filago eriocephala), Boraginaceae (Alkanna orientalis), Nonea ventricosa), Caryophyllaceae (Petrorhagia caricifolia), (Silene coniflora), Cyperaceae Schoenoplectus lacustris)Gentianaceae (Centaurium meyeri), Lamiaceae (Marrubium parviflorum), (Nepeta nuda), Liliaceae (Fritillaria strausii), (Tulipa clusiana), Poaceae (Bromus intermedius), Plantaginaceae (Linaria simplex), Polygonaceae (Polygonum convolvulus), (Polygonum hydropiper) and Rosaceae (Prunus lycioides). This study has also identified 33 Hawraman area species as Kurdistan endemics, of which three (Silene avramana, Astragalus tawilicus, and Dionysia bornmuelleri) are restricted to Hawraman of Iraq and Iran and determined as critically endangered according to IUCN Red List.There are four different vegetation zones in Hawraman: moist steppe zone (about 264 km2or 44% of the total Hawraman area, forest zone (about 322 km2, or 48% of the total Hawraman area), timberline zone (about 18 km2, or 3% of the total area of Hawraman), and thorn-cushion or subalpine zone (about 24 km2, or about 4% of the Hawraman total).The vascular plants of Hawraman area are made up primarily of herbaceous species (92%), and trees and shrubs represent only 8% of total. The shared number of plant species between Hawraman and Iran is 748 (70%), Hawraman and Turkey is 630 (58%), and Hawraman and Syria is 318 (30%).

Keywords: Voscular Plant, Hawraman, KRG, IRAQ

Climate changes and their impact on livestock in the Kurdistan region of Iraq

Prof. Dr. Yousif M. S. Al-Barzinji[1]

[1]College of Agriculture Engineering Sciences, Salahaddin University-Erbil

Yousif.Noori@Su.Edu.Krd

Abstract

Livestock, represented by large ruminants (cows and buffalo (and small ruminants (sheep and goats (, is one of the important pillars of the agricultural economy. Environmental changes have a direct impact on the prosperity or decline of the numbers of these animals in the Kurdistan-region of Iraq, as the number of these animals is estimated at 5,403,701 heads. Environmental changes have a significant impact on the numbers of these animals at the level of the region (Erbil, Sulamania, Duhok and Halabja) as the results obtained in present study showed that the amount of annual rainfall has an important role in providing pastures and lowering the prices of feed, which increases the chance of increasing the numbers of these animals, as it is noted that rain amounts fell between 600-1100 mm/ year for the years 2018-2019 in the governorates of the region, which led to a significant increase in the numbers of large and small ruminants, while the decrease in the level of rain by 200-400 for the years 2020-2022 led to a sharp and significant decrease in the numbers of animals in the all governorates of the Iraqi-KRG, and large ruminants were numerically more affected by these environmental changes, such as the lack of appropriate amounts of rain and high temperatures, which led to a decrease in available natural pastures and a scarcity of fodder materials, in addition to the rise in the prices of fodder materials, which leads to the breeder being unable to meet the fodder needs of the animals, which affects their productivity and reduces their numbers, which requires official authorities to intervene to help breeders preserve this important national wealth.

Keywords: Climate changes, Pastures, Large ruminants, Small ruminants.

Potentialities of Marine Waste and Chitinous Polysaccharides in controlling Olive Dieback Fungi

Hayet Hfaiedh[1], Bouazizi Emna[1], Gharbi Yaakoub[1], Triki Mohamed Ali[1]

[1]Laboratory of Genetic Resources of the Olive Tree : Characterization, Valorization and Phytosanitary Protection. Institute of the Olivier Sfax, Route de l'Aéroport, B.P.10873000 Sfax

hayethfaiedh05@gmail.com,amnabouazizi@yahoo.fr,yaakoub.gharbi@yahoo.com,

mohamedalitriki2@gmail.com

The olive sector is considered one of Tunisia's strategic industries. However, due to the emergence of certain diseases such as olive tree decline, the fall in productivity has become noticeable. For this reason, the work is part of the biological control of pathogens causing the decay of olive trees.

The compost extract's phytotoxicity and antifungal activity were tested.

The physicochemical characterization of the compost made from marine residues shows a pH of 7.43, which is a good indicator of the progress of waste composting and a high electrical conductivity of 4 mS cm-1. The contents of dry matter are 44.94%, of organic matter 24.1% and of mineral matter 20.84%, while the content of nitrogen is 1.05% and the content of phosphorus is 4.62%. The phytotoxicity tests indicated a germination index exceeding 80% for tomato, cucumber and radish. The compost was harmless and did not have any phytotoxic effect. Antifungal trials were performed using the diffusion method on several pathogenic fungi, with compost extract. When filtered, the compost extract is very effective by totally inhibiting the mycelial growth of *Colletotrichum gloeosporioides*, *Fusarium solani*, *Fusarium oxysporum* and *Verticillium dahliae* in different proportions from 15% to 50%. By contrast, the sterilization of the extract by autoclaving reduces its antifungal efficacy. The in vivo tests on potato tubers and olive twigs confirmed the use-

fulness of the compost extract produced in the control of necrosis caused by the studied fungi compared to the sick untreated control.

the results obtained highlighted the interesting potential of compost derived from shrimp shell waste in the protection of olive crops against various fungal pathogens.

Keywords: Compost extract; shrimp shell waste; antifungal activity; phytotoxicity

In-depth exploration of spent coffee grounds chemical constituents: From chemometric approaches to investigation of antibacterial mode of action

Dorra Ayadi Zouari[1,2]*, Sarra akermia[1], Moufida Chaari[1], khaoula Elhadef[1], Chaima abdelhdi[2], Lotfi Mellouli[1], Sofia Agriopoulou[3], Walid Elfalleh[4], Theodoros Varzakas[3], and Slim Smaoui[1]

[1]Laboratory of Microbial, Enzymatic Biotechnologies and Biomolecules (LMEBB), Center of Biotechnology of Sfax (CBS), University of Sfax, Road of Sidi Mansour Km 6,BP "1177" 3018 Sfax, Tunisia
[2]Department of Biology, Faculty of Science of Sfax, University of Sfax, 3000 Sfax, Tunisia [3] Department of Food Science and Technology, University of the Peloponnese, Antikalamos, 24100 Kalamata, Greece
[4]Department of Life Sciences, Imam Mohamed Ibn Saud Islamic University (IMSIU), 11623 Riyadh, Saudi Arabia

Abstract

The global coffee industry generates substantial amounts of spent coffee grounds (SCGs) each year, posing a significant waste management challenge. In this context, this study aimed to investigate SCGs as a source of specific bioactive compounds with potential applications in high value-added products. Thus, three solvents, namely, acetonitrile, ethanol, and water, and their combinations were developed for SCGs extraction and simultaneous assessment of phytochemical compounds, antioxidant and antifoodborne pathogen bacteria activities.

Using the simplex-centroid mixture design, a ternary mixture of 56.57% ethanol, 8.69% acetonitrile, and 34.75% water favored the recovery of 67.01 mg GAE/mL (total phenolic content (TPC)), 2.45 mg QE/mL (total flavonoid content (TFC)), and the highest antioxidant activities for DPPH (IC50= 0.39 mg/ml). Furthermore, these extraction conditions ensured inhibition of *E. coli* and *L. monocytogens* with a minimal inhibitory concentration of 5.93 and 0.55 mg/mL, respectively. Chemical analysis was performed using LC-MS/MS, and

revealed the largest number of chlorogenic acid and its derivatives in SCG extract. This high number was anticipated since the extraction processes favor significant enrichment of the low abundant derivatives. Based on the predicted free energies of binding (ΔG), the docking simulations revealed that the tested compounds exhibited an effective antibacterial effect against the pathogenic bacteria by inhibiting the synthesis of the peptidoglycan involved in the formation of bacterial cell wall.

Keywords: Spent coffee ground, mixture design, phytochemical contents, biological activities, LC-MS/MS, molecular docking

Climate element (rainfall) impacted some of livestock indicators in the Arabian world

Khaleel Jawasreh[1,2] Mohammad Al Breiki [2],Khalil Abo Afifa[3] Yousif M. S. Al-Barzinji [4] Ahmad Al- Amareen[5] Hashim Murad Saed[6]

[1]Department of Animal Production, Faculty of Agriculture/Jordan University of Science and Technology, Irbid -Jordan
[2] Applied Research and Capability Building, Abu Dhabi Agriculture and Food Safety Authority, Abu Dhabi, UAE
[3]Arab forestry and Range land institute/The Arab Organization for Agriculture development, Syria
[4] College of Agriculture Engineering Sciences, Salahaddin University-Erbil, KRG- Iraq
[5] National Agricultural Research Center (NARC), Al Baqaa-Jordan
[6] Department of Agricultural extension and rural development /The University of Duhok, KRG-Iraq

Abstract

The Arab world has a wealth of resources that improve its food security and assist its ability to adapt to the various prevailing climate variations. Small ruminants are among the farm animals that most Arabian countries (both West and East Arabian) consider to be part of their traditional way of living. This study aimed at examining the Arabian countries' rangelands and rainfall, as well as how these variables relate to the small ruminant industry. Annual rangeland area and rainfall during a fourteen-year period were collected for this purpose from several official statistics book sources for all Arabian countries. The small ruminant data (Sheep and goat number, annual slaughtered number, annual red meat production and others) were then connected to rangeland and annual rainfall data. Proc Means, Proc Corr, and Proc GLM procedures of SAS software were utilized for the statistical analysis. The findings showed that rainfall and rangeland varied over time and between countries. Rangeland area and yearly rainfall were found to be substantially correlated with Range land

to Small ruminant Ration to red meat production, respectively. Highly significant correlations were determined between Small ruminants count, red meat production, slaughter number of animals. The majority of the rangeland, rainfall, and small ruminant variables under study showed a considerable variation between the West and East Arab countries. All Arabian countries have uncontrolled slaughter practices, as evidenced by the extremely high average number of small ruminant slaughters compared to the total number of small ruminants. Since small ruminants primarily rely on rangelands for their food, it can be concluded that the annual precipitation, one of the climate elements, has a significant impact on their productivity. As a result, the Arabian world should implement a strategy to protect the small ruminant sector from the dangers of low rainfall and other climatic elements that may directly affected the livelihood of many farmers that considered the majority of Arabian people.

Keywords: Rainfall, Rangeland, Small Ruminant Productivity

Distribution of a particular Awassi genetic lines to address Jordan's climate change challenge

Khaleel Jawasreh[1,2] Mohammad Albreiki [2]Ahmad Al amareen[3] Yousef M.S. Al-ABrzinji[4]

1 Department of Animal Production, Faculty of Agriculture/Jordan University of Science and Technology, Irbid -Jordan
2 Applied Research and Capability Building, Abu Dhabi Agriculture and Food Safety Authority, Abu Dhabi, UAE
3National Agricultural Research Center (NARC), Al Baqaa-Jordan
4College of Agriculture Engineering Sciences, Salahaddin University-Erbil, KRG- Iraq

Abstract

The objective of this study aimed to enhance food security in Jordan by improving meat quantity and quality in Awassi sheep through introducing two economical mutations, FecB and CLPG. The FecB mutation has been known to significantly increased fecundity in sheep, while the CLPG mutation enhances muscle hypertrophy. In this study, a group of 209 Awassi ewes were involved in the study where 10 heads were distributed to each collaborated farmer, then Half of the flock were inseminated with rams available from JUST university, that carrying the FecB mutation known as (FecB Awassi), while the other half was inseminated with rams carrying the CLPG mutation, aiming to introduce the mutations into Awassi sheep and investigate the genotype and allele frequencies through the studied population. After the lambing season, a genomic DNA extraction and genotyping process for the newborns using polymerase chain reaction (PCR)-RFLP for detecting the mutations of the FecB and CLPG genes was conducted and revealed successful introgression of the mutations, resulting in lambs carrying either the FecB or CLPG mutations. Our results showed the successful introduction of the FecB and CLPG mutations in Awassi sheep, with a considerable number of lambs carrying the mutation, in Jordan the frequencies of the mutations

were almost zero but now and after introducing the carrier rams to farmer's fields it has been increased to 0.41 (as heterozygous FecB genotype) and 0.50 for that CLPG heterozygous genotype (in the supported popualtion). Prolificacy was elevated to 2.5 by in the first generation that holds the FecB mutation. The new introduction of the mutation to farmer's fields will contribute directly to the livelihood of the farmers and enhancing food security in Jordan.

Keywords: Awassi, Callipyge gene, FecB gene, Gene and genotype frequencies

Biocontrol Potential of Endophytic Bacillus amyloliquefaciens (OM14) Against Fungal-Induced Dieback of Olive Trees Under Climate Change Conditions

Eetizez KAROUI [1], Manel CHEFFI [1], Monia ENNOURI[1,2], Mohammed ALI TRIKI

1- Research Laboratory of Genetic Ressources of Olive Tree: Caracterisation, Valorisation and Phytosanitary Protection , university of Sfax

2- Higher institute of applied science and technology of Mahdia , university of Monastir

eetizez.karoui.etud@fss.usf.tn ; cheffimanel@yahoo.fr ; ennouri_monia@yahoo.f and mohamedalitriki2@gmail.com

In Tunisia, olive cultivation plays a crucial economic role, however fungal diseases caused by soil-borne or wood-infecting are the primary cause of dieback of olive trees. The diversity of these pathogens, combined with the increasing impact of climate change, poses a significant threat to the sustainability of olive production. In response, many farmers rely on chemical pesticides, which negatively affect both the environment and human health. This highlights the urgent need to develop eco-friendly control strategies, particularly by promoting biocontrol methods.
The antifugal activity of the endophytic bacterium *Bacillus amyloliquefaciens* (OM14) against olive fungal diseases was demonstrated *in vitro* and in *vivo* using different methods.

The analysis of an endophytic bacterium, *Bacillus amyloliquefaciens* (OM14), revealed its ability to inhibit the mycelial growth of various fungi such as *Fusarium Solani*, *Fusarium Oxysporum* and *Biscogniauxia mediterranen* with inhibition rates ranging from 36% to 56.03%. Gene amplification confirmed the strain's identity and the expression of bioactive genes, including lipopeptides such as fengycin, surfactin, and iturin, which are responsible of the inhibitory effect against phytopathogenic fungi. Moreover, these strain can produce siderophores, fix atmospheric nitrogen, and solubilize phosphates, thus promoting plant growth. The *in vitro* test of these antagonistic bacteria evaluated their potential effect on inhibiting the germination of *Fusarium solani* conidia . These strains, along with their blends, exhibit a broad repertory of volatile organic compounds (VOCs). The bacterial filtrate from these strains

demonstrated their ability to inhibit fungi at different concentrations and durations. For the in *vivo* test, these bacteria were also evaluated on olive twigs, showing promising effectiveness in reducing the virulence of fungi. They were also tested on potatoes leaves to assess their ability to inhibit phytopathogenic fungi in other crops.

Conclusion: The present study concluded *Bacillus amyloliquefaciens* possessed antifungal activity against different fungal phytopathogens and had significant potential to control early blight disease and promote plant growth *In vitro* and *In vivo.* Furthermore, its effectiveness in plant protection and growth promotion becomes even more relevant under climate change conditions, which exacerbate the prevalence and severity of plant diseases.

Keywords: climate change, olive fungal diseases, endophytic, Bacillus amyloliquefaciens (OM14), lipopeptides, antifungal activity, *In vitro* test, *In vivo* test.

Environmental by Genotype interactions and their effects on growth rate of Awassi sheep reared in semi-arid region

Ahmad H. Al-Amareen[1*], Khaleel I. Jawasreh[23], Sami A. Awabdeh[1], Mohammad AlBreiki[3], Mustafa M. Alshdaifat[1], Mohamad Araishi[1], Mowafaq Sherydeh[1], Rawad Sweidan[1], Mohammad Aloueedat[1], Jomana Hijazi[1], Leqaa Alharbeed[1], Yousif M.S.Al- Barzinji[4]

[1]Livestock Directorate, National Agriculture Research Center, Albaqa'a 19381, **Jordan**;
[2]Department of Animal Production, Jordan University of Science and Technology, Irbid 22110, **Jordan**;
[3]Applied Research and Capability Building, Abu Dhabi Agriculture and Food Safety Authority, Abu Dhabi, **UAE**
[4] College of Agriculture Engineering Sciences, Salahaddin University-Erbil, KRG- **Iraq**
* Corresponding author: Ahmad H. Al-Amareen, e-mail: ahmad_alathamna@yahoo.com.

Abstract:

Due to its reputation for receiving little rainfall, Jordan's Almafraq region (where the sheep is reared) is susceptible to droughts and water shortages and poor range. Estimating genetic and environmental factors for growth traits in purebred Awassi sheep in Al Mafraq (semi-arid region) was the goal of the study. The study's data came from 3481 lambs born at the National Centre for Agricultural Research's (NARC) Al- Khanasri livestock and rangeland research station in Jordan over a 15-year period (2009–2023). Birth weights (BWT), weaning weights (WWT), and average daily gain from birth to weaning (ADG) were the traits under study. While genetic parameters were estimated assuming the mixed model using the Restricted Maximum Likelihood (REML) method process using the ASReml program, the environmental effects were estimated using the SAS program's General Linear Model (GLM) technique. BWT, WWT, and ADG were significantly impacted by the year of birth, dam weight at lambing, parity, lamb sex, and method of birth, however the examined growth traits were not significantly impacted by the dam's age ($P > 0.05$). BWT, WWT, and ADG had heritability estimates of 0.38±0.05, 0.21±0.05, and 0.16±0.05, respectively, and corresponding repeatabilities of 0.41±0.05, 0.39±0.06, and 0.32±0.05. Environmental correlations ranged from negative (-0.20) between BWT and ADG to high (0.98) between WWT and ADG, while phenotypic correlations

ranged from negative (-0.011) between BWT and ADG to high (0.98) between WWT and ADG. The estimated genetic correlations among the traits under study were high and strongly positive, ranging from

0.54 between BWT and ADG to 0.99 between WWT and ADG. To sum up, the findings ought to be used to a genetic selection program that aims to enhance Awassi sheep's growth performance.

Key words: Heritability, Environmental correlation, Repeatability, quantitative genetics sheep

Promoting Water Cooperation with Climate Change Diplomacy and the WEFE Nexus Approach: Opportunities and Challenges

MAJED M ABU-ZREIG
President, Irbid National University
Professor of Water and Environmental Engineering,
majed@inu.edu.jo; drmajedo@gmail.com

Abstract:

One of the main challenges facing Middle East and North Africa (MENA) region is water scarcity and climate change implications. The rapid population growth in the MENA countries, as well as widespread immigration, including refugees from conflict-impacted countries, add tremendous pressure on the limited natural water resources. Furthermore, resources mismanagement and climate change impacts exacerbate the imbalance of the water demand-supply budget. The absence of effective local, national and transboundary water governance has also contributed to the inefficient use of limited water resources, and aggravated socio-economic tensions not only between riparian, but also among water users within the states. Accordingly, water problems have become a source of tension among states, possibly also negatively impacting the socioeconomic development as well as the political stability in the region. My contribution explores the synergies between climate diplomacy and the WEFE Nexus in addressing water-related challenges. It highlights opportunities such as enhanced cross-sectoral collaboration, improved institutional mechanisms, and innovative financing for adaptive water management. However, challenges persist, including geopolitical tensions, policy fragmentation, and the complexities of translating nexus-based approaches into actionable strategies. By analyzing case studies and best practices, this study underscores the potential of integrating climate diplomacy with the WEFE Nexus to advance water cooperation and resilience in the face of climate change.