



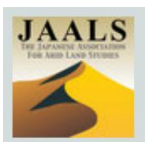
**INTERNATIONAL CONFERENCE ON ARID LANDS
"DESERT TECHNOLOGY XV"
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Preface

Acknowledgments

The Conference depends on the dedication of volunteers who plan technical session topic areas, solicit abstracts and papers, oversee reviews of submitted abstracts and papers, identify moderators, and ensure the overall success of the program. We appreciate the efforts of everyone involved, especially guest speakers and session chairs.

We also acknowledge the members of the Conference Organizing Committee; without whose time and efforts the event would not be possible.

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Deserts are generally envisioned places, where sand dunes spread. The U. N. Convention to Combat Desertification (UNCCD) in 1994 defined it as degraded arid semiarid and dry sub humid areas resulting from various factors, including climatic variations and human activities, including unsustainable farming, mining, overgrazing, and clear-cutting of land and manmade climate change. 41% of Earth's land area, home to over 2 billion people, falls in the category of deserts. Ninety percent of Jordan area is classified as arid land receiving less than 100 mm of annual rainfall. The issues of deserts and desertification are a global concern, requiring continued and expanding research to mitigate the consequences. As the dynamics of land, climate and biodiversity are intimately connected, the International Desert Council (ICD) facilitates cooperation and dissemination of knowledge among scientists, researchers and policy makers from diverse fields, in combating desertification and land degradation. Desert Technology (DT) Conferences since 1991 is one such unique initiatives of IDC, which facilitates technological breakthroughs and innovations. Building upon previous experiences and accomplishments, Desert Technology conference 15 (DT15) offers an opportunity to participate in discussions and the presentation of research projects (including natural, technological and human sciences) aimed at overcoming constraints of desertification. DT15 will be held to discuss the impact of desertification, possible solution and future challenges in the backdrop of climate change and food security in deserts and arid areas. On behalf of the Desert Technology 15 Organizing Committee, I invite and welcome all of you to Jordan.

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Basic Study on Local Carbon Circulation by Unused Bioresources -Case Study of Rice Husk and Willow as Biochar in Hydroponics

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Abstract: This study aims to establish the local carbon circulation system by unused bioresources. This report was evaluated alternative hydroponics substrates that utilized rice husk and willow as biochar. Rice huskchar(RHC) and willow char(WC) were tried as substrates in addition to rock wool(RW) as commercial products to grow cherry tomatoes under different water conditions (low irrigation and conventional irrigation). As a result, the water content of all media under conventional irrigation was about 40%, whereas, under low irrigation, RHC and WC were drier than RW. Nevertheless, under both irrigations, RHC and WC showed similar results of RW in the fruit yield and quality (brix value, acidity, lycopene, and amino acids). Besides, these substrates can contribute to carbon sequestration if they were used for soil amendment after using substrates in hydroponics. The persistent carbon contents of RHC and WC were calculated as 42, and 68 t-CO₂/ha, respectively, in this experiment system. Thus, the utilization of unused bioresources as biochar showed the possibility of providing alternative substrates to RW, and the potential of carbon sequestration locally.

Keywords: Hydroponics, Biochar, Rice Husk, Willow, Carbon Circulation

Change in soil moisture and salinity under Border irrigation, Everyfurrow irrigation and Permanent skip furrow irrigation

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Abstract: In dryland, irrigation is essential for agricultural production. However, salinization induced by irrigation is serious problem. Indo-Gangetic plains (IGP) is severe area of salinization, that area extend to approximately 6.7 million ha. In India, border irrigation (BI) is widely used, but high salinity water causes severe salinization. Therefore, water-saving is effective mitigate salinization. Permanent skip furrow irrigation (PSFI) is an easy and low-cost water saving method which irrigate every alternate furrow instead of all furrows, and the irrigated furrow is fixed. In this study, to clarify the change in soil moisture and salinity (EC) with the application of Every furrow irrigation (EFI) and PSFI, we conducted lysimeter (2.0*2.0m) experiment in India. Pearl millet (rainy season) and Mustard (dry season) were cultivated in the lysimeter from 2018 to 2021, BI (Control), EFI, and SFI was applied in Mustard cultivation. The irrigation water amount of one time was, 50, 45 and 23 mm respectively. The results showed that average volumetric water contents of EFI and PSFI was decreased 20 and 30% respectively compare with BI. On the other hand, average soil EC of EFI was increase 19% compare with BI, but that of PSFI was no difference with BI. The yield of Pearl millet tended to decrease from 4-24% with EFI and PSFI compared to BI. In contrast, yield of Mustard was tended to increase 26-64% in 2019 and 2020. EFI could save 10% water compared to BI, but it may adversely affect crops due to salt accumulation in the ridge.

Keywords: Drylands, Salinization, Water-saving, Skip furrow irrigation

Changes in carbon accumulation and soil properties through mangrove forestation in Southeast Thailand

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Abstract: Mangrove forests are an extremely valuable natural resource due to their high productivity and fundamental role in maintaining the biological diversity of coastal and marine environments. In addition, they play an important role in the carbon cycle by sequestering atmospheric CO₂ and storing it as carbon biomass in plant materials and sediments. We evaluated the ecosystem carbon stocks, carbon accumulation rates, and soil properties in mangrove afforestation and reforestation sites and natural forest of southeast Thailand. Mangrove reforestation and afforestation were performed in abandoned shrimp ponds and new mudflat beside the Gulf of Thailand since 1998 and 2005, respectively. Consequently, carbon stocks in biomass and soil increased drastically through afforestation and reforestation. In addition, their carbon accumulation rate had a comparatively high value at reforestation sites in abandoned shrimp pond. And differences among soil physicochemical properties (pH, Eh, EC, Na concentration, bulk density, water content, and temperature) at each soil depth were examined. As a result, correlation relationships between soil carbon stock and physicochemical properties such as pH, EC, Eh, bulk density, elapsed year, and temperature in sites were confirmed in the abandoned shrimp pond. Soil properties and carbon stocks in afforestation and reforestation sites tended to gradually approach their values in natural forest. Therefore, the recovery of carbon stocks through mangrove afforestation and reforestation in Southeast Thailand can contribute to coastal environmental restoration and blue carbon ecosystem restoration.

Keywords: Afforestation/Reforestation, Carbon accumulation, Mangrove, Soil properties, Thailand

Changes in Consumer Preferences for Functionality of Vegetable Oils in Japan: A Case Study of Edible Argan Oil

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Abstract: In terms of vegetable oil consumption in Japan, the consumption of olive oil has increased significantly due to the growing health awareness. In recent years, based on this background, the consumption of vegetable oils such as sesame oil, which is positioned as high-value-added products, has also been growing up. Argan oil is produced from the seeds of argan tree distributed only in Morocco, and is also classified as a luxury oil. In addition, as with olive oil, it has a high content of unsaturated fatty acids and has functionality as a countermeasure against cardiovascular disease and hypertension. On the other hand, the recognition of argan oil in Japan remains low. In order to strengthen the foundation of economic development, improvement of the export for this valuable resource to the world including Japan. This study attempts to compare the consumer preference for vegetable oils among Japanese consumers between two time points and quantitatively evaluates whether the growing consumer preference for the functionality of olive oil has spilled over to the preference for argan oil. Internet questionnaire surveys were conducted on 2013 and 2022. In this survey, a choice experiment method was applied with same attribute toward to both years. As the results, based on the higher consumer preference for unsaturated fatty acid content rather than 2013, improvement of health awareness among Japanese consumers are revealed. On the other hand, awareness of argan oil remains low and more information needs to be promoted in the future.

Keywords: edible argan oil, choice experiment, consumer preference, functionality

Comparative analysis of attitudes within dry-climate countries towards disaster risk reduction and relationships with efforts to combat desertification

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Abstract: This study investigated the attitudes of dry-climate United Nations (UN) member states toward disaster risk reduction (DRR) by analyzing publication frequency by country, classification of affiliated institutions, and text mining of official statements published on the Global Platform for DRR (GPDRR) forum. Official statements can be considered proxies for member states' stances on DRR. GPDRR is the premier global forum for discussing the "Sendai Framework for Disaster Risk Reduction: 2015–2030" (SFDRR) hosted by the UN Office for DRR (UNDRR). Consequently, dry-climate member states were more active than others in participating and expressing their views in the international arena of the DRR field. However, in half of the member states, DRR is handled by the humanitarian and security sectors, which are disconnected from issues such as desertification, ecosystems, sustainable land use, and agriculture. This suggests that these countries' approaches to disaster risk management consider humanitarian issues after disasters, rather than preventive environmental management, which is not necessarily consistent with the intent of the SFDRR or UNDRR policies. This clearly indicates the need for collaboration between arid land studies and the DRR sector in dry-climate member states.

Keywords: disaster, international arena, national statement, issue linkages, sustainability

Cut-Soiler assisted sub-surface sodicity reclamation for rice-wheat production in Indo-Gangetic plains

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Abstract: In India about 6.73 Mha land is salt-affected out of which around 3.78 Mha is under sodic soils. Besides infelicitous crop management practices, injudicious use of sodic water possess grave risks to soil health. High Residual Sodium Carbonate (RSC) water (12.7 me L⁻¹) and high Sodium Adsorption Ratio (SAR) restrict the natural drainage, a rationale to surface and subsurface sodicity development. On farm residue burning is also a burgeoning problem now-a-days in the semiarid region of Indo-Gangetic Plains, where rice-wheat cropping system is predominantly followed. To fathoming the twin problems, semi-controlled column study is being conducted under Indian Council of Agricultural Research -Central Soil Salinity Research Institute (ICAR-CSSRI) and Japan International Research Center for Agricultural Sciences (JIRCAS) collaborative project. The treatments consisted of surface application of gypsum (SA), surface and sub-surface placement (50 cm below the surface) of rice straw residue and gypsum that is an imitation of sub-surface Cut-soiler assisted drains in field condition. The columns were irrigated with water having RSC<2 me/l and >5 me/l. Preliminary results showed that Cut-soiler imitated subsurface drainage can successfully reclaim sodic soils. Surface application of amendment and subsurface placement of gypsum, rice straw residue at 50 cm depth reduce sub surface sodicity. Comparatively higher reduction in pH was up to 1.67 units and 1.2 units in the columns irrigated with water having RSC<2 me/l and >5 me/l, respectively under surface and subsurface application of gypsum and residue. Consequently, the respective increase in the rice yield was up to 12.7% and 9.4% under the same treatment. The foresaid treatment is followed by surface and subsurface application of gypsum only with approximately 7% increase in yield.

Keywords: Sub-surface sodicity, Residual sodium carbonate (RSC), Cut-soiler, Reclamation.

Cut-soiler constructed preferential shallow sub-surface drainage spacing optimization for field scale salinity management

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Abstract: Salinization is a long-standing problem that has threatened crop production and food security in arid and semi-arid regions. Salt accumulation in the rootzone results in loss of soil fertility and alters the soil properties and therefore harmfully impacts soil's environmental functions. To alleviate the impact of soil salinity, various technical measures and strategies have been developed over time. Cut-soiler constructs residue filled shallow sub-surface drainage to enhance outflow of salts and manage the root zone salinity even with the simultaneous irrigation of saline groundwater for sustainable production. This field study was conducted (2018-2021) to standardize the optimum lateral spacing of Cut-soiler in saline field. Cut-soiler PSSD was constructed at 2.5-, 5.0-, 7.5- and 10.0-meter lateral interval at a depth of 60 cm using rice residue as a filling material @ 6 Mg ha⁻¹ and control (without Cut-soiler). The Cut-soiler PSSD reduced soil salinity continuously and consistently from its construction in May 2018 to April 2021. After three years of Cut-soiler operation, the highest reduction in Electrical Conductivity of extract of saturated soil (EC_e) i.e., up to 52.4% was recorded in closest lateral spacing of Cut-soiler drains i.e. 2.5 m as compared to initial EC_e values. The lateral spacing of 5.0, 7.5 and 10.0 m reduced 38.7, 35.9 and 31.4% salinity (EC), respectively over their corresponding initial EC_e values. The narrowest lateral spacing of Cut-soiler constructed PSSD was found to reduce soil salinity up to 52.4% over no Cut-soiler plots. Therefore, closer spacing (2.5 m or less) found promising for salinity management in highly salt-affected fields for sustainable agricultural production.

Keywords: Cut-soiler, root zone salinity, management, preferential subsurface drain (PSSD).

Date Palm Value Chain Analysis, Development, and Competitive Advantage of Qatari Date Palm Sector in the International Market: Market Shares, Revealed Comparative Advantages, and Trade Balance Indexes

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Abstract: This study aims to assess the date palm value chain and the competitive advantage of the Qatari date palm sector in the international market. This study is conducted in the frame of the project "Developing Sustainable Production Systems for Date Palm in the Gulf Cooperation Council Countries - GCC", funded by the GCC Secretariat, and implemented, in partnership, by ministries of agriculture, agricultural authorities, and agricultural research institutions in the six GCC countries of the Arabian Peninsula (Kingdom of Bahrain, United Arab Emirates, State of Kuwait, State of Qatar, Sultanate of Oman, and Kingdom of Saudi Arabia) and the International Center for Agricultural Research in the Dry Areas (ICARDA).

The first part of the study considers the vision of how to develop an efficient value chain and development strategies to improve the value chain in Qatar. The main key factors of inclusive and sustainable development of the date value chain are determined to carry out the appropriate actions for improving the date palm sector in Qatar. To explore the challenges and opportunities leading to the improvement of the marketing, commercialization, and competitiveness of dates and date palm products in this country, an

analytical tool guideline (SWOT) was framed. Based on the SWOT analysis, the diversification of date varieties, and orientation toward modern plantations are the most important strengths of the date value chain. However, the increasing competition in regional and global date markets is the major threat to the date sector in Qatar. There is a good possibility to promote the date processing industry in Qatar given the rising demand for fresh and processed dates in national and international markets. A profitable and competitive date palm sector could be achieved by focusing on high yield and commercial varieties to ensure higher date palm productivity and the orientation toward adoption of quality standards to meet international market demand.

In the second section, we focused on assessing the competitiveness of the Qatari date palm sector in the international market. After a quick overview of the trends of different production and trade aggregates, with a special focus on the date palm sector (production, harvested area, and yield), we embarked on calculating a list of widely used indicators in competitiveness studies. The set of chosen indicators includes the Market Share (MS), Revealed Comparative Advantage (RCA), and the Trade Balance Index (TBI). This set of competitiveness indicators have been calculated to better understand and reflect on the date trade balance performances of the State of Qatar. The Market Share (MS) indicator was used to identify size advantages and the degree of specialization of a given country on the international market of a given commodity. The Revealed Comparative Advantage (RCA) has been defined as a measure of global trade competitiveness of a given country for a given commodity. Finally, the Trade Balance Index (TBI) was used to analyze whether Qatar has specialization in export (as net-exporter) or in import (as net-importer) for a specific group of products (Case of date palm products).

Data from both FAOSTAT and UN COMTRADE sources was used for the calculation of these indicators. The empirical findings reveal that the market share of Qatar was very low and unstable. This indicator was progressing well in 2012 (0.036%) and decreased to reach 0.011% in 2013. In 2015, this index was increased to reach 0.029% and decreased in 2016 by almost 0.0001% in 2016. The RCA for Qatar was very low in 2000, with an index of 0.05. This reflects that the country dates export share for 2000 was 0.05% higher than its share in total world export of agricultural goods. This index was decreasing in 2009 and 2011 to reach 0.46 and 0.94, respectively. Unfortunately, this index was decreasing to reach 0.02% in 2016, and consequently, Qatar is considered not competitive in the international date palm market given its very low comparative advantage. The TBI

indicator for the country is negative during the period 2001-2016. This index was -1 in 2001, -0.95 in 2005, and -1, in 2016. This reflects that the country is a net importer of dates. The empirical findings suggest that given the important problems that affect dates producing in Qatar and the significant marketing opportunities both internally and in importing countries, it is paramount to setup a strategy for increasing the competitiveness, expand profitability, and growth of the dates value chain. This can be a pulling force to concerted find sustainable business-driven solutions to the main constraints the date palm subsector is leaving with. This strategy must be stakeholders' driven; clearly identify the vision on how to increase competitiveness and the marketing strategy (price leadership, quality leadership, and/or differentiation); what needs to happen to achieve real systemic impact in competitiveness; and where to focus investments (prioritize actions).

Keywords: Date palm value chain, date production, competitive advantages, competitiveness indices, market share, revealed comparative advantage, trade balance index, dates marketing, SWOT analysis, Qatar.

Determination of Irrigation Depth for Potato considering Weather Forecast and Cost for Water under a Saline Condition

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Abstract: We have presented a new scheme, "optimized irrigation", in which irrigation depth is determined such that net income during each interval is maximized considering weather forecasts and the price of water using WASH_1D/2D, numerical simulation models of water flow and solute transport in soils and crop growth. To evaluate whether the optimized irrigation is also able to restrict salinity stress without any intentional leaching, we carried out an irrigation experiment in a sandy field. Potato was grown in a greenhouse in Tottori, Japan, using a drip irrigation system whose emitter distance was 20 cm and lateral spacing was 60 cm. Seeds were sown on 3 September below each emitter. Three treatments were established: 1) irrigation with fresh water (F), 2) irrigation with 2 g/L of NaCl solution (C), 3) irrigation with 1.5 g/L of NaCl solution and irrigation depth was determined with the proposed scheme (O). "F" and "C" were irrigated with automated irrigation systems using soil moisture sensors. Leachings were carried out on "C" on 12 (10 mm) and 21 (16 mm) November. "F" received the least amount of water owing to zero leaching requirement while "O" and "C" received almost the same amount. Treatment C received the lowest amount because of low transpiration rate due to severe salinity stress. Net income was calculated under a producer price of 0.4 \$/kgFW of tuber and the price of water at 0.05 \$/m³. O gained the as high net income as F, revealing the effectiveness of the proposed scheme.

Keywords:

Diagnostic assessment during wet and dry seasons of simple weir structures constructed by small-scale irrigation farmers in Zambia

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Abstract: In rural areas of Zambia, small-scale farmers have been using buckets, irrigation cans, and food plates to irrigate crops. Simple weirs have been introduced in six provinces in Zambia to ease the challenges that small-scale farmers face when diverting river water for irrigation. So far, three concerns regarding simple weirs have been identified. The first concern is the high rates of damage to these facilities, the second concern has been the lack of improvement since they were introduced a decade ago and the third one is the scarcity of information on simple weir technology as an alternative river water diversion method. Thus, the focus of this study is on assessing and identifying the primary and secondary causes of damage (breaching, collapsing) to single-line simple weir structures that are constructed by farmers in Zambia. Also, to propose a mechanism for improving the structure using alternative construction materials. We assessed simple weirs constructed in the Luapula, Copperbelt, and North-western provinces by small-scale farmers themselves. 15 sites with single-line simple weirs were randomly selected in this research 5 from provinces. The first phase of the investigation was conducted in the dry season (November- December) while the second investigation was done in the rainy season (December- January). Both phases were conducted in series. After determining the causes of damages to simple weirs, the research proposes the following aspects: revisiting the existing designs, construction procedures, and implementation. Finally, the research would enhance the current understanding of the simple weir technology now and in future implementations. Simple weirs have been introduced in six provinces in Zambia to ease the challenges that small-scale farmers face when diverting river water for

irrigation. So far, three concerns regarding simple weirs have been identified. The first concern is the high rates of damage to these facilities, the second concern has been the lack of improvement since they were introduced a decade ago and the third one is the scarcity of information on simple weir technology as an alternative river water diversion method. Thus, the focus of this study is on assessing and identifying the primary and secondary causes of damage (breaching, collapsing) to single-line simple weir structures that are constructed by farmers in Zambia (How long these weirs are in operation?). Also, to propose a mechanism for improving the structure using alternative construction materials. We assessed simple weirs constructed in the Luapula, Copperbelt, and North-western provinces by small-scale farmers themselves. 15 sites with single-line simple weirs were randomly selected in this research 5 from provinces. The first phase of the investigation was conducted in the dry season (November- December) while the second investigation was done in the rainy season (December- January). Both phases were conducted in series. After determining the causes of damages to simple weirs, the research proposes the following aspects: revisiting the existing designs, construction procedures, and implementation. Finally, the research would enhance the current understanding of the simple weir technology now and in future implementation.

Keywords: small-scale farmers, simple weirs, river diversion, damage, irrigation

Does synchronization of biennial bearing in olive production exist?: Evidence from the Mediterranean countries

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Abstract: “Biennial bearing” is a typical phenomenon for horticulture crops including olive production, in which a high yielding year and low yielding year came one after the other. The reduction of this fluctuation of fruit-bearing between “good” and “bad” year may contribute to mitigate the volatility of income for olive-growing farms. On the other hand, the synchronization of biennial bearing has been a well-known phenomenon in the Mediterranean region since the time of ancient civilizations. This synchronization phenomenon is observed among certain orchards or among certain regions located nearby where olive trees growing together. This synchronization is a major phenomenon of olive production in the Mediterranean region; however, the empirical evidence is missing. Hence, the objective of this paper is to empirically investigate whether the synchronization phenomenon of the biennial bearing of olive production exists. We use country-level panel data of olive production in the Mediterranean countries. After controlling climatic conditions which may affect olive production, we test if the geographical proximity significantly explain the variation of the level and the fluctuation pattern of olive production. Assuming spatial correlation of the error term due to the geographical proximity, we estimate spatial regression model of olive production using geographical weighted matrix. The basic assumption to prove the existence of synchronization here is that countries located nearby follow the similar pattern of biennial bearing. We expect spatial effect, i.e., geographical proximity, significantly explain the variation of the level of olive production as well as pattern of biennial bearing.

Keywords: Olive, biennial bearing, synchronization, geographical proximity

Drying Characteristics and Mathematical Modeling of Quince dehydrated in the Domestic Solar Dryer

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Abstract: The availability of Quince like most of the other horticultural products is seasonal. In Kashmir valley Quince is available in abundance during autumn. A cost effective and simple technique for storage is solar drying of the products. Normally the Kashmiri population resorts to open sun drying (OSD) of Quince for storage purposes. The open sun dried Quince is of poor quality. In this study Quince is dried in a domestic solar vegetable dryer designed by the authors. The quality is compared for both the drying routes. Dehydration of Quince slices without any pre-treatment at diverse temperature and invariable air velocity was conducted by means of the designed Domestic Solar Dryer. The experimental data was fitted using different mathematical models for samples dried in Solar dryer and in open sun respectively. The weight of the sample and air temperature were recorded continuously during the experiment and corresponding drying curves were obtained. By using the designed dryer, the drying time reduced to more than half while the moisture content reduced to 6.05 ± 0.035 %, which can be determined by the higher R^2 and lower RMSE values. The water activity reduced to 0.405 ± 0.012 where the microorganisms cannot develop. The products dried in the solar dryer show better transmittance (85% - 90%) owing to the lesser absorption values. The color of dried samples is fairly acceptable, rehydration ratio and shrinkage yielded better outcome for the solar dried samples as compared to OSD samples which is significant as observed by the T-test.

Keywords: Ascorbic acid, Moisture content, Non-enzymatic browning, Shrinkage, Water activity

Effect of seasonal change and strain difference on 1,4-dioxane phytoremediation by fast-growing willows

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Abstract: Hydroponics test of four willow strains by solution contaminated 1,4- dioxane was conducted, to study seasonal performance changes of phytoremediation in summer and autumn. Four willow strains (*Salix pet-susu* (KKD and HB471), *S.pseudolinearis* (FXM), *S. sachalinensis* (SEN)) were grown in hydroponic solution contaminated 1,4-dioxane for 20 days, 4 cycles of 5 days per cycle in the summer and autumn. Hydroponic solution including 2 mg L⁻¹ of 1,4-dioxane, was exchanged every cycle, and the hydroponic solution was sampled before and after the exchange. The amount of 1,4-dioxane removal during the test period was calculated, based on the change in 1,4-dioxane concentration in the hydroponic solution and the amount of transpiration by the plants. As the results 1,4-dioxane removal in 5 days (%) in summer were 16.5 to 32.8 %, on the other hand, they were lowered to 2.4 to 3.3 % in autumn. Transpiration of KKD and HB471 ranged from 268.6 to 656.7 g/pot in the summer growing season, however, they decreased to 27.9 to 43.5 g/pot in the autumn defoliation season, which led to lower 1,4-dioxane removal in autumn. As for strain difference, KKD and HB471 showed a significant decrease in transpiration and 1,4-dioxane removal in the autumn, meanwhile FXM and SEN did not show significantly. Consequently, the efficiency of 1,4-dioxane removal can be affected by both of seasonal change and strain difference.

Keywords: Phytoremediation, 1,4-dioxane, Fast-Growing Willow (*Salix* spp.), *Salix pet-susu*

Evaluation of salt leaching in salt-affected soil amelioration with coal bio-briquette ash in China

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Abstract: Salt-affected soils are widespread in countries with arid and semiarid conditions, where a decrease in agricultural production due to excessive salts is a very serious problem. Recently, the need for development of new, clean coal-refining technologies has risen in China. In this research, we ameliorated salt-affected soils with coal bio-briquette ash, and the positive effects and carbon sequestration due to soil amelioration have been confirmed. In addition, we investigated the effect of salts leaching into coal bio-briquette ash by using a soil column equipped with tensiometers and four-electrode sensors. Combustion ashes from coal bio-briquettes made from low-quality coal, biomass (corn stem), and a desulfurizer ($\text{Ca}(\text{OH})_2$) were added to two types of salt-affected soils in China. Consequently, initial Na leaching was confirmed from the results of the leachate EC and Na content of the leachate at 3.0wt% and 6.0 wt% application rates. Soil amelioration with coal bio-briquette ash originating from high-sulfur coal was examined. These results also indicate that ash has the possibility of ameliorating high-EC and high exchangeable sodium percentage (ESP) soils. Finally, we predicted the necessary water volume for Na leaching in all fields by using the experimental results from the soil column experiments and the meteorological data. Consequently, we could estimate the quantity of irrigation water necessary for soil reclamation. These results indicated the effectiveness of using low-quality coal bio-briquette ash as an amendment to salt-affected soil, and its use in predicting the reclamation time and necessary volume of water for soil amelioration.

Keywords: Coal bio-briquette, Hydraulic conductivity, Salt-affected soil, Salt leaching, Soil amelioration

Evaluation of soil water dynamics in subsurface irrigation system OPSIS using lysimeter experiments

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Abstract: In drylands and islands of tropical regions, changes in rainfall characteristics due to climate change are causing an increasing in extreme weather conditions such as drought and short-term duration heavy rainfall. Because of the limited irrigation facilities, agricultural activities in these areas rely mainly on rainwater and groundwater. However, these water sources are also unstable and strongly influenced by rainfall characteristics, so development of irrigation technology that achieves both water-saving and preservation of groundwater quality is strongly required. The optimized subsurface irrigation system (OPSIS), a water-saving subsurface irrigation system developed in Japan, is designed to irrigate upland crops by soil capillarity. Since irrigation water is supplied from perforated 50-mm pipes installed above a waterproof PVC sheet in the subsurface, downward infiltration is prevented and dispersal loss of water does not occur, thereby achieving a highly effective water-saving irrigation. The purpose of this study is to demonstrate the soil water dynamics under OPSIS in a subtropical island in Japan. The water supply in a lysimeter field without vegetation from OPSIS showed a decreasing trend similar to that of potential evaporation and was highly variable depending on rainfall events. This result suggests that the infiltration water caught in the waterproof PVC sheet induced OPSIS to stop supplying water. After the start of irrigation, soil water increased at 35 and 55 cm near the 60 cm depth from the OPSIS installation point and soil moisture conditions remained high except at 5 and 15 cm depths. Therefore, installation of OPSIS at 60 cm depth could effectively irrigate sugarcane with high water-saving effects, except immediately after planting.

Keywords: OPSIS, Subsurface irrigation, Drylands, Lysimeter, Water-saving

Fluctuations in soil drainage properties in different salinization treatments

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Abstract: Soil sodification is one of the soil degradations that irrigated agriculture often faces in arid and semi-arid land, resulting in a significant decrease in productivity. Assessing the impact of different water qualities - irrigation water, groundwater, and rainfall - on soil drainage is important to achieve sustainable land management for irrigated agriculture. We performed salt treatments with different salt compositions (R_{∞} , R10, R0; $R = \text{Na}/(\text{Ca})^{1/2}$ (cations: molc L⁻¹)) and concentrations (0.05N, 0.01N, 0.001N) on Indian and Uzbek soils with similar soil texture (sandy clay loam). We investigated the effect of treatments on the hydraulic conductivity (HC) by continuously leaching soil columns with each treatment solution and plotting the fluctuation of HC along the cumulative amount of leaching solution. As a result, the effects of swelling and dispersion by Na on drainage properties were separately observed. In addition to supporting existing findings that dispersion is triggered under low concentration below the critical coagulation concentration (CCC), our results showed that the CCC varied with the degree of sodification, even for a single soil mineralogy. Rapid deterioration in HC by particle dispersion only in Indian soils but not in Uzbek soil in the R10, 0.001N treatment revealed that CCC also differed depending on mineralogy. Furthermore, the decrease in HC in the R_{∞} , 0.05N treatments indicated the sequential formation of a clogging layer by dispersed particles. Finally, we will discuss the results obtained so far on the changes in HC by additional salt treatments after leaching.

Keywords: Sodification, Hydraulic conductivity, drainage, salt affected soils

Increased uranium pollution in groundwater and the Amu Darya River over 15 years in Karakalpakstan, Uzbekistan

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Abstract: The Amu Darya River and the surrounding groundwater aquifers are important resources for drinking water and agricultural use in Karakalpakstan, western Uzbekistan. However, access to these water resources has been limited because of the region's arid climate. Considerable concerns for water quality are the contents of minerals and uranium. In Karakalpakstan, soil salinization has been caused by years of inappropriate and excessive irrigation with highly mineralized water. Local people in rural areas of Karakalpakstan use groundwater for drinking water purposes; therefore, the quality of this ground-water must be considered regarding its use as drinking water. High uranium concentrations in drinking water can increase the risk of health issues such as kidney disorders. In this study, the concentrations of uranium were measured by inductively coupled plasma mass spectrometry to evaluate the quality of groundwater and the Amu Darya River. The uranium concentration of the river water was more than two-fold greater than in 2004. The uranium concentrations exceeded the WHO guidance value at some groundwater sampling locations. A correlation analysis between the mineral and uranium contents in groundwater showed a strong correlation when the uranium concentration was less than 100 µg/L. Conversely, there was no obvious correlation at uranium concentrations greater than 100 µg/L. While low uranium levels can accumulate naturally with salts, extremely high uranium levels are likely the result of intensive human-caused pollution.

Keywords: Uranium content, Uzbekistan, Large scale irrigation, Aral Sea

Investigation on water delivery performance and its quantification in large-scale Beni Amir irrigation scheme, Morocco

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Abstract: In many arid regions of the world, irrigated agriculture is the dominant water user. Monitoring irrigation system performance and improving water use efficiency are integral to sustainable water management due to increasing water demands for agriculture and the other sectors under limited water resources and climate change conditions. Morocco is a country that severely affects current and future water scarcity. This study investigated the planning and management of water delivery practices and assessed the water delivery performance (WDP) of the Beni Amir irrigation scheme of about 34,000 ha in Morocco. WDP was evaluated at the lateral canal level in terms of adequacy, dependability, and equity. There are 14 lateral canals in the scheme, and they were categorized into 3 parts: head, middle, and tail. The data on climate and crops, such as cropping areas and patterns, were used to calculate irrigation water requirements for 2016, 2017, and 2018. We collected the daily discharge of each lateral canal and irrigation time for each field to calculate the water supply to all fields. These calculations were aggregated on 10 days intervals based on irrigation frequency and the performance indicators were calculated. The water delivery performance: adequacy, dependability, and equity, were evaluated as poor in all years. However, the dependability in water distribution to farmers is not as low as expressed in the indicator. Equity is also low because that farmers use groundwater as a supplemental water source due to absolute water scarcity.

Keywords: Water delivery performance, Water supply, Irrigation water requirement, Dryland

Land Degradation Assessment of Dakhla Oases Using Remote Sensing and Field Measurements

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Abstract: Land degradation is a process, which lowers the soil productivity, it implies a regression from a higher to lower state; a deterioration in soil productivity and land capability. Most forms of land degradation are man-made problems. The assessment of land degradation is dependent mainly on soil properties, topography and climatic factors. Evaluation of natural vulnerability of the soils is essential to extract the human impact on land degradation. The main objective of this study is to assess the land degradation processes in Dakhla Oasis, western desert of Egypt. The main processes are sand dune encroachment, salinization, water logging and urban sprawl. To monitor and assess the recent movements of the sand dunes in Dakhla oasis area, multi-temporal satellite images and a GIS-developed model using Python script in ArcGIS were used. The satellite images (SPOT images, 1995 and 2007) were geo-rectified using Erdas Imagine. The frontiers of individual dunes were measured at these different dates and movement rates were analyzed in GIS. Image subtraction was performed using spatial analyst in ArcGIS, the result of image subtraction obtains the sand dune movement between the two decades. The raster and vector shape of sand dune migration were automatically extracted using spatial analyst tools. Integrating remote sensing and GIS provided the necessary information for determining the minimum, maximum, mean, rate and area of sand dune migration. Migration rates of sand dunes were calculated using the developed model.

Keywords: soil degradation, sand dune, remote sensing, GIS

Linking population fluidity and olive production in Jordan and Syria

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Abstract: There is a well-known phenomenon in tree crops known as “biennial bearing,” in which the fruit-bearing increases or decreases every other year. Synchronization of biennial bearing has been more prevalent in olives of the Eastern Mediterranean region, which includes Jordan and Syria, rather than fluctuations associated with rainfall and other climatic conditions. This synchronization phenomenon is thought to have been accepted in the region since the time of ancient civilizations, but modern science has not been able to elucidate its mechanism. On the other hand, the biennial bearing and synchronization phenomena have significantly been disrupted since the beginning of the 21st century. The disappearance of biennial bearing and the reversal of synchronization can be observed since 2008 in Syria and since 2015 in Jordan. These periods coincide with when the problems of refugee inflows into Syria due to the Iraq War and into Jordan due to the Syrian Civil War became apparent, respectively. Therefore, this study examines the hypothesis that social, political, and economic factors, which have been neglected in agronomy, have substantially influenced those phenomena in olive production. Field surveys and experiments are conducted in the Irbid governorate of Jordan, where olive production is the most dominant agricultural activity, with significant inflows of labor and consumer population from the bordering parts of Syria. Then, a nonlinear model is developed to link the population fluidity with the chaotic olive production dynamics.

Keywords: Olive, biennial bearing, synchronization, population fluidity

Optimization of the Capacity of Water Harvesting using Plastic Sheet and Tank in a Sandy Field.

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Abstract: In semi-arid climates, rain-fed agriculture often faces long dry spells and crop losses. The use of plastic sheets combined with tank may enable to harvest water in sandy fields where runoff seldom occurs. To present a methodology to determine an optimal tank capacity, we cultivated Garlic (*Allium sativum* L.) on sand dune, Japan under three treatments, A, B and C having the same cultivation and plastic sheet surfaces areas of 24m² and 12.5m², respectively. Tank capacities for treatment A, B and C were set as 500, 300 and 200L, corresponding storability of 21, 13, and 8 mm, respectively. Water was automatically applied through a drip irrigation system using tensiometers. Results showed that treatment A increased stored water by 15 % and 28%, as well as it increased cumulative irrigation depth by 15 % and 39 % compared to B and C, respectively. As a result, bulb yield was higher for A by 6% and 18% compared to B and C, respectively. The optimum storability that gave the highest net income was around 18 mm. The collection efficiency of each treatment for A, B and C was 98%, 96% and 96% respectively. The methodology was suitable to determine the optimal storability of the tank.

Keywords: Supplemental irrigation, drip irrigation, drought stress, storability, garlic

Performance of UASB -vertical flow constructed wetlands for treatment of grey water generated in arid and semi-arid regions

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Abstract: Adopting conventional high-tech systems to treat wastewater generated from small rural communities is neither feasible nor practical. Alternatively, anaerobic pre-treatment followed by natural-based treatment systems such as the constructed wetlands offers an economically and technically viable solution. The main objective of this research is to demonstrate the efficacy of an integrated system consisting of a UASB septic tank followed by a vertical flow constructed wetland (VFCW) for the treatment of grey water generated from rural areas in Jordan. UASB septic tank of 142 L (OLR of 4.85 kg COD/m³. d, HRT of 11.5 hrs.) followed by vertical flow constructed wetlands of 12m² surface area (surface loading rate of 11 gBOD₅/m².d) was employed. Results have shown that the UASB-VFCW system is capable of achieving an effluent with total COD and suspended solids concentrations of 27.2 mg/L and 10.8 mg/L, respectively. Resembling removal efficiencies of 98.8% and 94.0% for the total COD and suspended solids, respectively. The effluent quality with respect to COD, BOD, TN, NH₄, TP and TSS complies with the Jordanian standard of reclaimed water agricultural reuse. Moreover, the VFCW attained 4.1 and 5.1 log reductions for the total coliform and e-coli. Accordingly, the UASB-VFCW proved to be technically feasible and economically efficient for the treatment of grey water generated in the rural areas of arid and semi-arid climates.

Keywords:

Potential Use of Reclaimed Wastewater Resources for Mega Scale Projects in Jordan

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Abstract: In search of viable water resources in dry countries hit by climate change and explosive population growth to satisfy the requirements of mega scale project, Jordan explored the use of nonconventional resources, such as reclaimed wastewater for cooling the proposed nuclear power reactors. Wastewater effluent from AsSamra wastewater treatment facilities has been statistically analyzed to assess the reliability as a source for cooling the first Jordanian NPPs both quantitatively and qualitatively. Statistical analyses using six different distribution functions (Normal, Log-Normal, 3 Parameter Gamma, Log-Pearson Type Three (LP3), Gumbel, and General Extreme Value (GEV)) were performed for the quantity and the nine regulated quality parameters of AsSamra WWTP effluent. The statistical distribution that gave the best fit for each parameter was used to determine the value with a 95% confidence to be used as a design parameter. When compared to suggested cooling water standards, Total Dissolved Solids (TDS), Chloride (Cl-) concentration, and total and carbonate hardness were in violation of these standards. Thus, a tertiary treatment for the treated effluent is needed.

Keywords:

Pressure of Agricultural Practices in Irrigated Farming on Soil Properties and Groundwater Quality in the Northern Badia of Jordan

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Abstract: Jordan is a country that faces "absolute water scarcity" and may not be able to meet its water needs by the year 2030 as a result of various impacts; the most critical is climate change. Groundwater is the major water resource for many areas of the country and the only source in other areas. Most of the groundwater basins in Jordan are already exploited beyond their estimated safe yield. This deterioration is accelerated by the irrational agricultural practices on soil and water quality, hence proper farm management is one of the main aspects of the health local agro-ecosystem sustainability. The aim of this work was to evaluate the agricultural practices impact in the eastern part of Jordan, the place where more than 1500 underground wells are active in agricultural activities. Evaluation included monthly monitoring of the effect of agricultural practices on the soil properties and groundwater quality. Soil samples were collected inside and outside farms and water samples were collected from the wells used to irrigate the farms; the samples were analysed frequently. Also, a survey questionnaire was conducted in the targeted six sites, including farm labour, owners, people involved in the farming system, types of crops, fertilizers and pesticides used and their application rates, the extension services provided to farmers, and the agricultural practices regarding fertilizer and pesticide usage. Results indicated that there is diverse cropping systems by the top majors were fruit trees and vegetables production which considered the most water consuming commodities. Both chemical fertilizers and pesticides are intensively used however there is a limited use of organic compost and manure. The water samples showed limited changes in water minerals, pH and EC, while the water salinity is varied. The increase in water salinity resulted in using water filter that reflects negatively on the production cost as well as the brine ecological accumulation.

Keywords: Agricultural Practices, Electrical Conductivity, Reclaiming Soils

Regionalization of Flash flood for Jordan

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Abstract: A methodology for determining the potential flash flood volume and peak in arid basins is presented. In this study, regional equations were developed for estimating peak flow and volume for gauged and ungauged catchments in Jordan. Data from 11 catchments were collected including rainfall, flood flow, land use and soil texture, and topography. HEC-Hms model was used to estimate the peak flow and volume using the above data. Then, catchments physical characteristics such as area, slope, channel length were derived utilizing Geographic Information System and digital elevation model. Regional equations for determining peak flood and volume for different return periods were developed by establishing multiple regression relationship between the catchments physical characteristics and peak flow and volumes. The estimated peak flow and volume for various catchments were in good agreement with observed values.

Keywords:

Salinity management through Cut-soiler assisted drainage for sustainable mustard production in Indo-Gangetic plain

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Abstract: In India, about 6.74 M ha area is salt-affected, out of which saline and sodic soils account for approximately 2.95 and 3.79 M ha, respectively. About 5.5 million ha area also suffers from problem of waterlogging in the country. The management of saline soils often requires higher drainage intensity for quick leaching of salts from the soil profile; however, the existing drainage techniques involve heavy machinery and higher cost. Cut-soiler is a tractor-mounted, easy to use farm implement that constructs residue filled sub-surface drains. It uses surface scattered crop residue as filling material for preferential water flow to drain out excess water and salts from the operated area. This semi-controlled lysimeter study was conducted at ICAR-CSSRI in collaboration with JIRCAS during 2019-2021. The simulated Cut-soiler drains were constructed in 12 lysimeters along with 12 control (without Cut-soiler) as main plots. The two soil types i.e. saline (light textured sandy loam) and non-saline (heavy textured silty clay loam) were laid as sub plot treatments and three irrigation water salinity (4, 8, 12 dS m⁻¹) were applied in sub-sub plots in two replications. The Cut-soiler resulted in higher outflow of free water and salts with drainage during events of irrigation and rainfall. Hence, Cut-soiler reduced ~60 % soil salinity after two years and improved mustard yield of successive crops. The Cut-soiler treatment significantly increased mustard seed yield by 31.5 % over control. The Cut-soiler could be an effective technique for salinity, it can even be applied at individual farm level in a single operation.

Keywords: Cut-soiler, salinity management, drainage, mustard

Sand Movement Analysis of the Tottori Sand Dunes Using Aerial Photogrammetry by UAVs

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Abstract: The Tottori Sand Dunes, located along Japan's Sanin Coast, are a UNESCO Global Geopark and a popular tourist attraction with millions of annual visitors. Monitoring of environmental conditions including sand movement is needed for protection and utilization of the dunes. The objectives of this paper were (i) validation and evaluation of aerial photogrammetry using three UAVs (Unmanned Aerial Vehicles: Drones) and two types of software and (ii) sand movement analysis of the Tottori Sand Dunes using the best results. For each flight, about 2000 vertical photographs (side overlap: 60%, and top-bottom overlap: 80%) were taken at altitudes of approximately 100 m above ground level using three UAVs for a 1500 m² area of the dunes. The obtained images were processed using two types of SfM (structure from motion) software, PhotoScan Professional (currently Metashape: Agisoft) and Pix4Dmapper (Pix4D), for building 3D models. The position data of survey piles in the dunes were used as the GCP (ground control point) setting for image processing and model evaluation. Results revealed that, the accuracy of the elevations was not much affected by differences in the UAVs, while it was greatly affected by differences in the software. The models obtained from PhotoScan were generally curved and had large errors at the peripheral areas, while the models obtained from Pix4Dmapper had smaller errors throughout the entire areas. Comparison of the models obtained from Pix4Dmapper showed that the characteristic landforms in the dunes had moved or been buried between 2016 and 2018.

Keywords: drone, structure from motion (SfM), three-dimensional model, digital surface model (DSM)

Sludge drying reed beds and potential benefits of land application in arid lands

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2. Civil engineering Department, School of Engineering, The University of Jordan, Amman 11942, Jordan
3. Department of natural resources and Environment, Faculty of Agriculture, Jordan University of Science and Technology, Irbid 22110, Jordan
4. Biosafety and Biosecurity Center, Royal Scientific Society, Amman 11941, Jordan
5. Department of Civil Engineering, Jordan University of Science and Technology, Irbid 22110, Jordan

Abstract: Current sludge management practices in Jordan might be considered the most feasible; nevertheless, they are not the most sustainable. In general, and due to regulations' constraints, sludge is either being landfilled or piled in the wastewater treatment plants at selected locations. It might also be transferred to certain allocated dumping sites when areas within the treatment plant are not available for storage, or when thickened sludge is produced. Moreover, and on many occasions, sludge landfilling is becoming challenging since operated landfills are restricting sludge admission into their sites. The total amount of sludge produced by 29 wastewater treatment plants in Jordan was calculated to be 104-110 thousand tons of dry matter in the year 2020 with projected amounts of 132-159 thousand tons in the year 2035. Sludge characterization revealed its compliance with the national sludge standards JS1145/2016 with respect to heavy metals. However, pathogenic content did not comply with class A biosolids. Accordingly, sludge treatment and reuse might be considered as a sustainable solution that exploits resources and improves soil agronomic value. In this research, Sludge drying reed beds offered a reliable and feasible approach for sludge treatment in which the final product contained 40% of organic carbon and high content of nitrogen and phosphorus with concentrations of 7% and 1.7%, respectively. High organic content is expected to improve carbon content of poor soils, while nutrients content might be considered for agricultural fertilization. Moreover, pathogenic contents for all collected samples were less than 1000 MPN/gm, which meets class A requirements according to Jordanian standards.

Keywords:

Solar energy-powered net house

Arash Nejatian^{1*}, Abdul Aziz Niane², Vinay Nangia³

Activities Coordinator Officer, Soil, Water, and Agronomy, Arabian Peninsula

1 Regional Program, International Center for Agricultural Research in the Dry Areas(ICARDA).

2 Regional Coordinator, Arabian Peninsula Regional Program, International Center for Agricultural Research in the Dry Areas (ICARDA).

3 Research Team Leader - Soils, Waters and Agronomy, International Center for Agricultural Research in the Dry Areas (ICARDA)

Abstract: Food production under controlled environment agriculture (CEA) is rapidly increasing, particularly under desert ecosystems. Most of the CEA is operated using the high water and energy consumption evaporative cooling system compromising its sustainability, economic viability and environmental fit. The evaporative cooling system consumes more water than crop requirements by four folds. For a single-span greenhouse, the annual energy bill would reach 35-40% of the total running cost, with a carbon footprint of a small car running around for a year. To overcome the above challenges, ICARDA and national partners in the Arabian Peninsula (AP) developed, tested, and optimized a combination of solar energy-powered root zone cooling, closed hydroponics, and ultra-low-pressure drippers (ULPD) under net-house. By eliminating the evaporative cooling system, the combined package reduced energy and water consumption by up to 95% and 80%, respectively. Utilizing the ULPD reduced the energy required to operate the irrigation pump by about three times, significantly cutting the establishment cost for solar energy. The system operates with sensors attached to the solar energy-powered automatic controller for cooling, irrigation, and fertigation management, which is the first step towards adopting precision climate- smart agriculture technology in CEA. This paper aims to share the additive impacts demonstrated by incorporating five greenhouse technologies on the water- and energy-use efficiency, cost-effectiveness, environmental health, and potential approach on CEA in desert ecosystems.

Keywords: solar energy, net house, root zone cooling, hydroponics, ultra low pressure dripper

The impact of the soil erodibility model on soil water erosion quantification under South African soil types

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Abstract: Soil erodibility is highly related to the response of soil to rainfall at the field level. Soil response to rainfall at the field level is a highly dynamic process. Since the 1950s, soil erodibility has been calculated quantitatively using field plots. However, the experimental nature of the soil erodibility factor makes it difficult to estimate the sediment using single published models developed under conditions different from the area where they can be applied. The study attempts to evaluate the impact of using different soil erodibility models on the erodibility distribution and quantification of erodibility magnitude. Combinations of various erodibility models and soil profile information were used to map the soil erodibility at the national scale. The primary soil parameters used in the models were extracted from the national soil profile database and land-type maps. The study revealed a high matching trend between different models in terms of the identification of high erodible soil areas. This can be attributed to the general dependency of soil erodibility on the soil texture and organic matter content. In general, the models showed that the South African soils are between the medium and high erodible soils except for areas located in the east part of Eastern Cape Province and East South of the Free State Province. A map has been developed to identify areas with high erodibility discrepancies for further field studies and experimental evaluation.

Keywords: Erosivity; land degradation; rainfall simulation

TiO₂ nanoparticles in irrigation water alter critical flavonoid in crops, a food safety measure

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Abstract: Treated wastewater has been applied to irrigate various crops grown in an arid and semi-arid climate to improve crop production. Luteolin is a susceptible flavonoid with anticancer properties in many critical crops. Therefore, cellular luteolin content and synthesis can be considered as food safety indicators. Recently, the progressing trend of nanoparticle application has led to the inevitable direct contamination of crops, irrigation water, and soil in arid areas. Therefore, potential modification of their luteolin content and its chemical structure may be impacted. This study investigates the potential interaction of water containing the environmentally relevant TiO₂ nanoparticles (NPs) levels with the pure luteolin content that can be extracted from crops. Three replicates of 5 mg L⁻¹ of pure luteolin were exposed to a concentration series of TiO₂ nanoparticles (25, 50, 100 ppm) for 48 hours at room temperature using an in-vitro system. After exposure experiments, treatments were subjected to centrifuge and ultrafiltration. The filtrate samples were analyzed by Raman spectroscopy, UV-vis, and dynamic light scattering (DLS). A positive correlation was found between TiO₂NPs concentrations and structural alteration of luteolin content. We found that more than 20% of luteolin structure was possibly altered in the presence of 100 ppm TiO₂ NPs. Furthermore, DLS data revealed that the luteolin was adsorbed onto the TiO₂ NPs surface and the NPs hydrodynamic size was increased. This study provides fundamental insight into agricultural safety measures in exposure to air or water-born nanoparticles.

Keywords: luteolin, TiO₂, crops, water, safety

Trends in the simultaneous expansion of Japanese companies into different African countries

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Abstract: The study investigated the African business development from 2013 to 2019 of 79 Japanese companies with a presence in more than one African country. Many of these companies had shown a marked expansion in the countries in which they were operating since 2017. These companies were categorised into two groups according to their expansion patterns. The 64 companies in the first group had already expanded into several countries between 2013 and 2015 and had expanded into more countries since 2017. On the other hand, 15 companies in the second group had entered several new countries simultaneously from 2017 onwards. The first group included companies from a variety of industries, including manufacturing, agriculture, forestry and fisheries, transport, finance, trading and information and communication, while the second group included manufacturing and general trading companies, mainly in the automotive-related industries. The pattern of expansion into multiple countries between 2017 and 2019 was concentrated in Eastern Africa, including Uganda, Rwanda and Tanzania for both groups, and Southern Africa, including Zambia, Mozambique, Zimbabwe, Botswana and Namibia. This may be due to the fact that many companies are based in Kenya and South Africa, making it relatively easy for them to expand into neighbouring countries with common markets and business practices. On the other hand, simultaneous expansion into Western Africa was rarely observed, suggesting that there are still some barriers, such as language and business practices, that prevent Japanese companies from expanding.

Keywords: Japanese companies, business extension, Africa

Water-saving effects of subsurface irrigation system “OPSIS” during irrigation period for sugarcane cultivation: A case study in Ishigaki Island, Japan

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Abstract: Sugarcane is a water-intensive crop which is negatively impacted by climate change and therefore requires a proper irrigation facility to provide a stable water supply. Furthermore, nitrogen fertilizer applied at the beginning of sugarcane cultivation is not absorbed in early stages of growth may leaches down and causes nitrate contamination of groundwater in tropical and subtropical islands. Therefore, the development of an irrigation technology that improves water use efficiency and preserves groundwater quality is strongly required. The optimized surface irrigation system (OPSIS) is a solar energy based cyclic subsurface irrigation system that creates a saturation point under crop root zone and relies on soil capillary to supply irrigation water to the crop root zone. It was developed to facilitate efficient irrigation of field crops such as sugarcane. Therefore, we evaluated the functions of OPSIS as compared to traditional surface irrigation in order to clarify its performance in terms of maintaining water balance under subtropical environment conditions. Field scale and lysimeter experiments were conducted on Ishigaki island in Okinawa, Japan after the rainy season from June to August 2022. We carried out crop growth surveys and water balance observations during the irrigation period. There were no differences in cane stem length and SPAD values between OPSIS and surface irrigation. Furthermore, soil moisture in the root zone of sugarcane under OPSIS was maintained at optimum conditions for crop growth during the irrigation period and irrigation water was consumed at a low rate indicating efficient water-saving function. It was concluded that OPSIS may feasibly be implemented for sustainable sugarcane irrigation in Ishigaki Island and similar environments.

Keywords: OPSIS, Subsurface irrigation, Water balance, Sugarcane growth.

INTERNATIONAL CONFERENCE ON ARID LANDS "DESERT TECHNOLOGY XV" 2023



Conference Chair, Prof. Majed Abu-Zreig

Deserts generally envision places where sand dunes spread. The U. N. Convention to Combat Desertification (UNCCD) in 1994 defined it as degraded arid semiarid and dry sub humid areas resulting from various factors, including climatic variations and human activities, including unsustainable farming, mining, overgrazing, and clear-cutting of land and manmade climate change. 41% of Earth's land area, home to over 2 billion people, falls in the category of deserts. Ninety percent of Jordan area is classified as arid land receiving less than 100 mm of annual rainfall. The issues of deserts and desertification are a global concern, requiring continued and expanding research to mitigate the consequences. As the dynamics of land, climate and biodiversity are intimately connected, the International Desert Council (IDC) facilitates cooperation and dissemination of knowledge among scientists, researchers and policy makers from diverse fields, in combating desertification and land degradation. Desert Technology (DT) Conferences since 1991 is one such unique initiatives of IDC, which facilitates technological breakthroughs and innovations. Building upon previous experiences and accomplishments, Desert Technology conference 15 (DT15) offers an opportunity to participate in discussions and the presentation of research projects (including natural, technological and human sciences) aimed at overcoming constraints of desertification. DT15 will be held to discuss the impact of desertification, possible solution and future challenges in the backdrop of climate change and food security in deserts and arid areas. On behalf of the Desert Technology 15 Organizing Committee, I invite and welcome all of you to Jordan.

TEMPLATES

Download, fill & email (Dt15amman@gmail.com)

- [Registration Form](#)
- [Extended Abstract Template](#)
- [Poster Template](#)

Organizing Committee

Prof. Majed Abu-Zreig, Chair
 Prof. Khaled Shawaqfeh/Jordan
 Prof. Khaldoon Bani Hani/Saudi Arabia
 Prof. Amjed Zraiqat/Jordan
 Prof. Mutawakil Obaidat/Jordan
 Dr. Laith Al Rousan/Jordan
 Dr. Rami Alkhatib/Jordan
 Mr Moath Alenizi/Jordan
 Miss Fawzia Ammoura/JO/ Assistant

History of DT /ICAL Conferences

- DT-1: 1991 - Santa Barbara, USA
- DT-2: 1993 - Hawaii, USA
- DT-3: 1995 - Motosu, Japan
- DT-4: 1997 - Kalgoorlie, Australia
- DT-5: 1999 - Nevada, USA
- DT-6: 2001 - Urumqi, China
- DT-7: 2003 - Jodhpur, India
- DT-8: 2005 - Nasu, Japan
- DT-9: 2008 - Douz, Tunisia
- DT-10/ICAL-1: 2011 - Narita, Japan
- DT-11: 2013 - Texas, USA
- ICAL-2: 2014 - Samarkand, Uzbekistan
- DT-12: 2015 - Cairo, Egypt
- DT-13: 2018 - Pondicherry, India
- DT-14: 2021 - Tokyo, Japan
- DT-15: 2023 - Amman, Jordan



Discover Jordan!


Jordan is one of the most attractive places for tourists in the region. The rose city of Petra, the Dead Sea and Wadi Rum are among the most important tourist destinations. Post conference optional tours will be arranged for participants to those places.



The organizing committee is looking forward to welcoming you in Jordan

3rd circular
The DT XV International Conference on Arid Land 3-6 June 2023 JORDAN.

The DT XV International Conference on Desert Technology



Contact Us
 Conference Chair: Professor Majed Abu-Zreig
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Submission and Conference email: DT15amman@gmail.com
 Website: DT-XV

DT15 conference, Jordan, Dead Sea, 3-6 June 2023

About the conference

DT "Desert Technology" conferences has been continuously held since 1990 and named "International Conference on Arid Land" since 2011. Next year 2023 the DT XV will be held in Jordan. The conference language is English. All conference submissions are peer reviewed on the full paper. The conference series address:

- The natural characteristics of arid areas and desertified areas (e.g. climate, hydrology, and vegetation).
- The mechanism of the desertification, and prevention methods.
- The human sciences towards overcoming constraints of arid land.

Abstract Submission

- One page abstract: **Friday, 9 December 2022**
- Acceptance notification: **Friday, 27 January 2023**
- Registration deadline: **Friday, 10 February 2023**
- Manuscript submission (Extended 4 pages Abstract): **Friday, 5 May 2023**
- All materials: send to DT15amman@gmail.com
- Abstracts will be published in a Proceedings.
- The papers presented in the conference will be published in The **Journal of Arid Land Studies** after critical peer review process.

Scientific Committee

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- Dr. Qasim Abdelal/Jordan
- Dr. Rami Alkhatib/Jordan
- Prof. Mutawakil Obaidat/Jor.
- Prof. Amjed Abolzeirek/Jordan
- Dr. Laith Al Rousan/Jordan
- Prof. Yoshiko KAWABATA/Japan
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- Prof. Toshihori Kojima/Japan
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- Prof. K. Toderich/Uzbekistan
- Prof. H. El-Shemy/Egypt
- Prof. Y. Sakai/Japan
- Eng. Nabli Asaf
- Dr. Waleed H. Abou El Hassan/Egypt

Conference Topics

- Desertification of Land and Prevention
- Desert Environment
- Transboundary Dryland ecosystems & biodiversity
- Climate change and adaptation.
- Soil-water Management/conservation in Drylands
- Bio- and nano- technology for Sustainable D.
- Arid Land Bio-resources
- Water Desalination and Wastewater Treatment
- Irrigation and Soil-Water Interaction in Arid Areas
- Desert Afforestation and Carbon Sequestration
- Mangroves Ecosystems
- Arid halophyte production,
- Rangelands-livestock systems
- Renewable Energy Application in Desert and Remote Areas
- Information Technology and Remote Sensing
- Agriculture technology and food security.
- Economic benefits of dry lands and biological resources
- Cultural, human, social, biological, heritage conservation and history in arid lands
- Stress biology & desert agriculture
- Achievement of Sustainable Development Goals
- Progress against UN conventions (e.g. Desertification- UNCCD, Biodiversity - CBD and Climate - UNFCCC)
- Rainwater harvesting and soil erosion
- Groundwater management
- Water policy and governance
- Water/Energy/food nexus
- Flash flood prediction and management
- Crop production with saline water
- Organic Waste management
- Food trade and virtual water

Tentative Program

- 3 June: Transportation to Hotel/ Welcome reception at Hotel
- 4 June: Opening session/ Inauguration/ Academic Sessions
- 5 June : Academic Sessions at Conference hall/ Gala dinner at Hotel
- 6 June: Academic Sessions/ Trip to Al Walla Dam/ end of Conference
- 7-8 June: optional trips to Wadi Rum and Petra or Jerash and Umm Qais
- Detail of the program will be presented in Second Circular.

Registration Fees

REGISTRATION TYPE ^A	FULL PACKAGE [*]	WITHOUT ACCOMMODATION/TRANSPORTATION
International Participants	\$1000	\$700
Accompanying Person ^{**}	\$600	\$350
Participant, No publication [#]	\$800	\$500
Local Participants	JD 500	JD 250
Local, 1-day Registration		JD 150

- Registration include: Lunch, Dinner, Two coffee breaks, Local transportation, Conference material and Sessions.
- * Include: Airport pickup and drop-off, accommodation, breakfast.
- ** double room
- # Submitted abstracts are NOT eligible for publication in the Journal of Arid Land Studies
- Late registration (Friday 20 January 2023): 100 USD charge is added to the above rates.
- Registration on arrival (cash only): 150 USD charge is added to the above rates

Bank details for registration fee

Transfer (Japanese Yen)
 Bank Name: THE BANK OF TOKYO-MITSUBISHI UFJ, LTD
 SWIFT Code: BOTKJPJT
 Branch Name: SHINTOMICHO BRANCH
 Branch Address: 1-18-1, Shintomi, Chuo-ku, Tokyo, Japan
 Account Number: 749-0146874
 Account name: DT ICAL JAPANESE ASSOCIATION FOR ARID LAND STUDIES. (NIHONSABAKUGAKKAI)

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Agenda

International Conference on
 "INTERNATIONAL CONFERENCE ON ARID LANDS"
 DESERT TECHNOLOGY XV
 3-6 June 2023
 Dead Sea, Jordan

Arrival Day: Saturday 3/6/2023

10:30	Airport Pick up to Moevenpick dead sea, at 12:30 am, look for SIGN DT15 (EK2058 arrives Amman at 9:10; QR6100 arrives Amman at 9:30)
18:00 - 21:00	Arrival of participants to the hotel in the Dead Sea and check in at Moevenpick Hotel

First Day: Sunday 4/6/2023

8:00 – 10:00	Registration
	Conference Opening and Ceremony:
10:00 – 11:00	Prof. Majed Abu-Zreig, Conference Chair
	Dr. Jihad Almahameed, Secretary General, MWI
	Prof. Abdallah Malkawi, Presedent Prince Fahad Bin Sultan University
	HE Dr Hazem Elnasser, Conference Patronne and Key note speaker
11:00 – 11:40	Coffee break

11:40 – 13:00	Session 1: Chairs: Prof. Khaled Shawakfeh, JUST	Presenter	Country
11:40 – 12:00	Operational practices of water harvesting systems around the world	Koichi Unami	Japan
12:00 – 12:20	Effect of seasonal change and strain difference on 1,4-dioxane phytoremediation by fast-growing willows	Yuichi Ishikawa	Japan
12:20 – 12:40	Evaluation of salt leaching in salt-affected soil amelioration with coal bio-briquette ash in China	Yuji SAKAI	Japan
12:40 – 13:00	Investigation on water delivery performance and its quantification in large-scale Beni Amir irrigation scheme, Morocco	Muhammad Dayyabu	Japan
13:00 – 14:00	Lunch (all attendees of the opening Session)		

INTERNATIONAL CONFERENCE ON ARID LANDS "DESERT TECHNOLOGY XV" 2023

Session 2 Chairs: Dr. Unami, Kyoto University		Presenter	Country
14:10 – 14:30	Determination of Irrigation Depth for Potato considering Weather Forecast and Cost for Water under a Saline Condition	Haruyuki Fujimaki	Japan
14:30 – 14:50	Salinity Removal of Reclaimed Wastewater Using Natural And Modified/Nano Zeolite Particles	Ziad Al Ghazzawi	Jordan
14:50 – 15:10	Date Palm Value Chain Analysis, Development, and Competitive Advantage of Qatari Date Palm Sector in the International Market: Market Shares, Revealed Comparative Advantages, and Trade Balance Indexes	Muhi El Dine Hilali	Tunisia
15:10 – 15:30	Does synchronization of biennial bearing in olive production exist?: Evidence from the Mediterranean countries	Hajime KAMIYAMA	Japan
15:30 – 15:50	Increased uranium pollution in groundwater and the Amu Darya River over 15 years in Karakalpakstan, Uzbekistan	Yoshiko KAWABATA	Japan
16:00 – 16:30	Coffee Break		

Session 3 Chairs: Yoshiko KAWABATA		Presenter	Country
16:30 – 16:50	Pressure of Agricultural Practices in Irrigated Farming on Soil Properties and Groundwater Quality in the Northern Badia of Jordan	Fatima, A Bani Khaled	Jordan
16:50 - 17:10	JUST- Nitrate pollution of groundwater	Eman Bani-Khled, Ahmad Al-Ajlouni, Mutawakil Obeidat	Jordan
17:30-18:30	Meeting for the IDC member (invited)	Room will be determined	

Second Day: Monday 5/6/2023			
KEYNOTE	Keynote speech: Nangia, Vinay: Climate actions in agriculture: A prerequisite for food security		
9:30 – 10:30			
10:30 – 11:00	Coffee break		
11:00 - 13:00	Session 4 Chairs: Dr Mutawakil Obeidat, JUST	Presenter	Country
11:00 – 11:20	The impact of the soil erodibility model on soil water erosion quantification under South African soil types	Mohamed Abd Elbasit Mohamed Ahmed	South Africa/Sudan
11:20 – 11:40	Physiochemical Characteristics of Developed Modified Sand by Incorporating Natural Dune Sand” Mohammad Nadeem Akhtar, Khaldoon Bani Hani, Jamal K. Najem, Dima A. Malkawi	Jamal Najim	Saudi Arabia
11:40 – 12:00	Potential Use of Reclaimed Wastewater Resources for Mega Scale Projects in Jordan	Wa'il Y. Abu-El-Sha'r	Jordan
12:00 – 12:20	Sludge drying reed beds and potential benefits of land application in arid areas	Maha Halalsheh	Jordan
12:20 – 12:40	Sand Movement Analysis of the Tottori Sand Dunes Using Aerial Photogrammetry by UAVs	Tadaomi Saito	Japan
12:40 – 13:00	Performance of UASB -vertical flow constructed wetlands for treatment of grey water generated in arid and semi-arid regions	Ghada Kassab	Jordan
13:00 – 14:00	Lunch (full registered participants/accompanying person)		
14:10 – 16:30	Session 5 Chairs: Dr Laith Al Rousan, JUST	Presenter	Country
14:10- 14:30	Optimization of the Capacity of Water Harvesting using Plastic Sheet and Tank in a Sandy Field.	Jean Bosco NANA	Japan
14:30– 14:50	Consumer Preferences for Functionality of Vegetable Oils in Japan: A Case Study of Edible Argan Oil	Yuki Maruyama	Japan
15:10 – 15:30	Comparative analysis of attitudes within dry-climate countries towards disaster risk reduction and relationships with efforts to combat desertification	Yuta Hara	Japan
15:30 – 15:50	TiO2 nanoparticles in irrigation water alter critical flavonoid in crops, a food safety measure	Hamidreza Sharifan	USA
16:00 – 16:30	Coffee break		

INTERNATIONAL CONFERENCE ON ARID LANDS "DESERT TECHNOLOGY XV" 2023

16:30 – 18:00	Session 6 Chairs: Mohamed A.M. Abd Elbasit, Sol Plaatje University, South Africa	Presenter	Country
16:30 - 16:50	Solar energy-powered net house	Vinay Nangina <i>on behalf of</i> Arash Nejatian	UAE
16:50 - 17:10	Evaluation of soil water dynamics in subsurface irrigation system OPSIS using lysimeter experiments	Ken OKAMOTO	Japan
17:10 - 17:30	Changes in carbon accumulation and soil properties through mangrove forestation in Southeast Thailand	Yuji SAKAI	Japan
17:30 - 17:50	Basic Study on Local Carbon Circulation by Unused Bioresources - Case Study of Rice Husk and Willow as Biochar in Hydroponics	Tsuyoshi ODAGAKI	Japan

Third Day: Tuesday 6/6/2023 ONLINE SESSIONS			
9:30:00 – 11:00	Session 7 The Online session Chairs: Dr Saito Tadaomi/ Dr Hamidreza Sharifan		
11:00 – 11:15	Coffee break		
11:30-12:30	Session 8: Online Session	Presenter	Country
12: – 13:00	Discussion, Recommendations, Evaluation, END of Conference		
13:00 – 14:00	Lunch (full registered participants/accompanying person)		
15:00	First trip to the Airport at 14:00 (EK904 departs from Amman at 18:00 QR401 departs from Amman at 20:30)		
21:00	Second trip to the airport at 21:00 if necessary. EK906 departs from Amman at 26:05		
14:00	TRIP to WADI RUM AND PETRA, on (6/6)The bus will leave at 14:00 pm from the dead sea to Wadi rum, stay in Wadi Rum for one night. Next day (7/6) at 9:00 am the bus will leave to PETRA, at 3:00 PM the bus will leave PETRA to AMM AIRPORT arriving at 20:00. Participants should stay in AMM one night and leave the second day (8/6). THE TOTAL COST OF THE TRIP 300 USD/person (13 persons minimum) INCLUSIVE (including RUM and PETRA entrance fees =100 USD)		

Time in Jordan	Time in Tokyo, Japan	Time in New Delhi, India	ONLINE SESSION, Third Day: Tuesday 6/6/2023 (11:00 – 13:00)		
			Online Session. Chairs: Dr Hamidreza Sharifan/ Dr Saito Tadaomi Tottori U.	Presenter	Country
9:30-9:45	15:30-15:45	12:00 – 12:15	Salinity management through Cut-soiler assisted drainage for sustainable mustard production in Indo-Gangetic plain	Neha	India
9:45 – 10:00	15:45 - 16:00	12:15-12:30	Change in soil moisture and salinity under Border irrigation, Every furrow irrigation and Permanent skip furrow irrigation	Junya ONISHI	Japan
10:00 – 10:15	16:00 - 16:15	12:30 – 12:45	Fluctuations in soil drainage properties in different salinization treatments	Kayo MATSUI	Japan
10:15-10:30	16:15 - 16:30	12:45 - 13:00	Cut-Soiler assisted sub-surface sodicity reclamation for rice-wheat production in Indo-Gangetic plains	Manisha	India
10:30 – 10:45	16:30 - 16:45	13:00 - 13:15	Cut-soiler constructed preferential shallow sub-surface drainage spacing optimization for field scale salinity management	Gajender Yadav	India
10:45 - 11:00	16:45 - 17:00	13:15 - 13:30	Cut-soiler assisted subsurface placement of amendment and crop residue reclaim subsurface sodicity in semi-arid region of Indo-gangetic plains	Rajender Kumar YADAV	India
11:00 – 11:15	17:00 – 17:15	13:30 – 13:45	COFFEE BREAK		
11:15 - 11:30	17:15 - 17:30	15:00 - 15:15	Water-saving effects of subsurface irrigation system "OPSIS" during irrigation period for sugarcane cultivation: A case study in Ishigaki Island, Japan	Toshihiko ANZAI	Japan
11:30-11:45	17:30 – 17:45	15:15-15:30	Linking population fluidity and olive production in Jordan and Syria	Marie Sato	Japan
11:45 – 12:00	17:45 – 18:00	15:15 – 15:30	Drying Characteristics and Mathematical Modeling of Quince dehydrated in the Domestic Solar Dryer	Seeming Rubab	India
12:00-12:15	18:00 – 18:15	15:30 - 15:45	Trends in the simultaneous expansion of Japanese companies into different African countries	Takahiro MORIO	Japan

