

1.

Biogas energy potential in Syria: Prospects and challenges.

Syria suffers from a catastrophic civil war and a strong embargo that have negative consequences for all sectors and affects the country's exploitation of underground energy resources. Current low quantities of energy production and still increasing demand for reliable energy consumption open potentials for alternative sources of energy. Organic waste from different agricultural, industrial and domestic production has been increased in the last decades. However, methods of organic waste management are often ineffective in terms of health, environment and economic sustainability. Hence, it has become a necessary goal to seek effective technology that can convert organic waste into an energy source. The experience of producing biogas from agricultural and animal waste in developing countries is seen as one of the appropriate ways for generating renewable environmentally friendly energy. The main objective of this research is to investigate the feasibility of biogas production in Syria its prospects and challenges. A full profile about the biogas potential resources and biogas plants history in this Mediterranean country is provided. A comparison between the situation in Syria and its neighbor countries is shown in order to provide a glimpse about the biogas situation in the Middle East area. The study found that although there is a real crisis in the securing of energy resources in Syria, biogas production technology has not been widely deployed yet due to the economic, technical, social, and other causes and difficulties. The study found that the basic components of the application of biogas production technology in Syria are available through the presence of suitable quantities of organic waste and the moderate climate in the region.

2.

In Vitro Conservation and Recovery of *Ullucus Tuberosus* (LOZ.) after Reduced Growth of Microshoots

In vitro conservation by the use of reduced growth is considered to be a reliable biotechnological tool for medium-term conservation of plant germplasm while ensuring its immediate availability. In the present study, we assessed reduced growth condition using five culture media supplements, a cultivation temperature of 4 °C and a 24 h in vitro growth in complete darkness, to establish a simple and reliable in vitro conservation protocol for ulluco (*Ullucus tuberosus*). Ulluco is an Andean tuberous crop rich in carbohydrates and vitamin C and it represents a staple crop for local people. For this experiment, individual nodal segments of ulluco were precultured for 28 days on half-strength Murashige and Skoog (MS) medium maintained in a culture room under a 16/8 h light/dark regime at 17 °C, and at a photosynthetic photon flux density of 35 $\mu\text{mol m}^{-2} \text{s}^{-1}$ provided by cool-white fluorescent tubes. They were then transferred to half-strength MS medium supplemented with mannitol (10–30 g l⁻¹), sorbitol (10–30 g l⁻¹), sucrose (10–120 g l⁻¹), chlorocholinchlorid (CCC; 300–700 mg l⁻¹) or abscisic acid (ABA; 1–3 mg l⁻¹) and were placed in a cultivation temperature of 4 °C and a 24 h dark conditions for 24 months. Based on survival percentage and number and size of MTs, three superior treatments were selected for further experiment on microtuber germination: mannitol (20 g l⁻¹), sorbitol (30 g l⁻¹) and sucrose (90 g l⁻¹). Three regrowth media were tested: MS, half-strength MS and MS supplemented with 0.5 mg l⁻¹ GA₃. After 3-months survival, MT germination and morphological characteristics were evaluated. Results showed that MS cultivation medium supplemented with GA₃ and MTs originated from conservation medium supplemented with 90 g l⁻¹ sucrose showed the fastest regrowth and provided overall superior characteristics over plants from other conservation treatments and tested regrowth media. The protocol optimised in this study provides minimal labour and efficient method of ulluco conservation for 24 months.

3.

Indications of improved germination of sugarbeet pre-washed and primed with protein-based biostimulants.

Uniform and rapid germination of sugarbeet seeds after planting remains a major challenge to sugarbeet seed producers. This is largely due to several biochemical compounds reported to be present on the sugarbeet seed coat. Some of the reported compounds present on the seed include; salt-crystals, free ammonia, osmolytes and unsaturated yellow oil. Several attempts have been made to improve germination in several crops including sugarbeet and an important seed enhancement technology method is seed priming. This study aimed to investigate the effect of hydrolyzed wheat gluten (HWG) and potato protein (Pp) priming (priming agents), pre-washed with saline or tap water on sugarbeet germination. Sugarbeet seeds (0.88 g in 3 replicates) were pre-washed in either tap water or 10 g/L saline, slightly agitated at 100 r/min for 2 h and re-dried for 24 h to initial weight. Then, pre-washed seeds were primed in either 1 or 10 g/L solutions of hydrolyzed wheat gluten (HWG) and potato protein (Pp) slightly agitated at 100 r/min for 48 h and re-dried for 48 h to initial weight. Unwashed seeds and milliQ water-priming were the control treatments. There was significant ($p < 0.05$) effect of pre-washing on germination, as saline improved germination of sugarbeet compared to tap water and unwashed seeds. Either HWG and Pp did not significantly ($p < 0.05$) improve germination of sugarbeet. However, the interaction effect of pre-washing (saline, tap water and unwashed), priming agents (HWG, Pp) and concentration (0, 1 and 10 g/L) was highly significant on germination. Saline pre-washing and milliQ water priming (0 g/L) gave the highest germination weight and it is similar to the germination of saline pre-washed seeds primed in 10 g/L HWG and 1 g/L Pp. Only 1 g/L Pp pre-washed in tap water was also similar to the former treatments. Unwashed sugarbeet seeds were generally low in germination across all treatments. Therefore, 10 g/L HWG and 1 g/L Pp priming pre-washed in saline, improved germination of sugarbeet as well as 1 g/L Pp pre-washed with tap water.

4.

Farmers perception regarding drip irrigation system in District Attock.

Agriculture is consigned as the most important element of Pakistan. It contributes 20.9% to GDP and almost 43.5% of the entire labor of the country is involved in this sector. It supplies a total of 60% of its contribution to the economy by exports and provides raw materials for different industries. Pakistan has abundant water resources, but the misery is that we are not getting proper benefits from these resources. The only way to overcome this situation is to increase water productivity by adopting modern and efficient technologies for sustainable agriculture, which can lead to poverty reduction, profitability and improved food safety with job opportunities. Drip irrigation, water is supplied to the soil with the help of mechanical devices called as the emitters (located on water pipes along with selected points). The two types of methods used in drip irrigation technique are surface drip irrigation system (water is delivered at or near the root zone of plants, drop by drop) and subsurface drip irrigation system. The goal of work was to obtain information about the awareness of farmers regarding new techniques of irrigation systems used in Pakistan. In the year 2015, the questionnaire data were processed from 120 farmers who came mainly from the Attock district (89.2%), region Punjab Subsequently, and their analysis was carried out using an appropriate statistical method Software (SPSS). About 45.0% of farmers were old aged (>50 years old). About one-third of respondents (34.2%) had a bachelor's degree. More than one quarter (28.3%) had five years of farming experience. One-third (33.3%) reported sand and clay type of soil in their field. Fair majority (69.2%) small farmers (< 12.5 acres) only 3.3% had large farm (>25 acres) size. The vast majority of respondents (84.2%) believed that the irrigation system should be accepted by our colleagues. One-third of

respondents (38.3%) said their work ratio was reduced to 1: 3 while less than one-third (32.5%) of respondents said their work ratio had dropped to one quarter. In Pakistan agriculture, this would be advisable because it minimizes evaporation and water drainage. Through this system, fertilizers can be delivered which helps in improving yields.

5.

How agroforestry systems may impact pests and diseases in Robusta coffee in Ecuadorian Amazonia.

Coffee agroforestry systems could potentially reconcile agricultural, social and environmental objectives, especially in tropical regions, where farmers are generally poor. We assessed how agroforestry and different types and levels of intensification affected pest and disease development on *Coffea canephora* (robusta coffee) trees in Joya de los Sachas, in the Ecuadorian Amazon. The five coffee shading methods assessed were: 1) full sun (no shade); or *Musa* spp. AAB (plantain) at 333 plants ha⁻¹ combined with trees of 2) *Myroxylon balsamum*; 3) *Inga edulis*; 4) *Erythrina* spp; or, 5) *Erythrina* spp. and *Myroxylon balsamum*. The four coffee farming practices assessed were: conventional farming at either 1) moderate or 2) intensified input or organic farming at 3) low or 4) intensified input. The experiment was an RCBD thus with 20 treatment combinations, replicated three times. A pyranometer was used to assess shade cover above the coffee in each plot. Infestation of pests and disease incidence of the following were evaluated monthly: the brown twig beetle (*Xylosandrus morigerus*), the coffee leaf miner (*Leucoptera coffeella*), the coffee leaf borer (*Hypothenemus hampei*), the coffee berry disease (*Colletotrichum* spp.), the thread blight (*Pellicularia koleroga*) and cercospora leaf spot (*Cercospora coffeicola*). Furthermore, coffee berry disease severity was assessed with the help of ImageJ. Agroforestry with *Inga edulis* reduced brown twig beetle infestation by 9%, compared with in the full sun treatment. Both brown twig beetle and coffee leaf borer infestation were both reduced by 12% in the intensified organic treatment compared with the intensified conventional treatment. Coffee berry disease severity was found to be only 3% greater within the intensified organic farming in comparison to the intensified conventional treatment. We conclude that both shade tree treatments and management strongly influence pest infestation levels and diseases incidence and therefore should be considered when selecting optimum management strategies for coffee cultivation.

6.

The (in)visible components of participatory action research (PAR).

Scientists are increasingly recognising the importance of transdisciplinary collaboration as well as the incorporation of different worldviews in research. Such components are claimed to be crucial in scientific studies attempting to assess and design complex social ecological systems capable to provide multiple ecosystem services and conservation of natural resources. Despite the importance to engage local actors as co-creators in the research process using transdisciplinary and participatory approaches, few studies present and assess effective methodologies for doing so. The focus is often on data collection and interpretation, while social values and strategies to approach local actors and build a relationship of trust and collaboration are often undermined and disregarded. In this paper, we discuss participatory action research as an approach for engaging with local actors and to develop effective strategies for building more sustainable and resilient agri-food systems. Based on a case study in Brazil, we highlight six main components that are crucial for implementing participatory action research: (i) Collective definition of research questions; (ii) Participatory methodologies for building scientific knowledge; (iii) Sharing and discussing research results with local actors (iv) Integration between research and education; (v) Strengthening capacity building and interdisciplinary team work; and (vi) Social engagement with farmers. Our findings shows that building a team of researchers with different theoretical backgrounds and learning styles is important for effectively engaging with farmers and their organisations, and making research outcomes more relevant for society. The use of participatory methodologies is crucial not only to make this process possible, but also to generate valuable scientific

data. However, engaging with farmers and different knowledge disciplines require extra effort and time from individual researchers, which is not always valued or recognized by academic systems. Yet, participatory research processes can be facilitated by long-term local networks involving organisations as Universities, NGO`s and farmer`s cooperatives/associations/movements.

7.

Controlled Drainage for Reducing Nitrogen Losses and Salt Concentrations under Rice Production in Rwanda.

Drainage water has been recognised as one of the causes of agricultural non-point pollution. Controlled drainage has a large effect in reducing nitrogen loads in drainage outflow in comparison to conventional drainage. Furthermore, rice paddies are major source of greenhouse gases (GHGs). Pronounced GHGs losses result from midseason drainage and dry-wet episodes in paddy fields. However, few studies have investigated the effect of controlled drainage on soil salinity management and nitrogen losses under rice production. A three cropping seasons (CS's) field experiment was conducted at Muvumba marshlands, in Eastern part of Rwanda to assess the effect of controlled drainage in managing salt concentrations in soil and nitrogen losses. The experiment entailed 12 plots (8×8 m), arranged in a randomised complete block design with four blocks and three treatments, which are conventional shallow drain: CV60 cm (control), deep conventional drains (CV120 cm) and controlled drainage (CD 120 cm). The soils are derived from granitic or igneous parent materials. Rice was used as test crop. The soil and water salinity was regularly monitored using electric conductivity probes; the drainage outflow was measured using HS Flumes and level sensors. Nitrogen concentrations in soil and drainage water were determined in the laboratory. A static chamber method was used to collect gas samples, which were analysed with a gas chromatograph. The results from this study will contribute in determining strategies to manage soil salinity and nitrogen losses for improved rice production in Muvumba irrigation scheme, Rwanda in particular as well as in the region at large.

8.

The Role of the Integrated Maize-soybean-chicken Value Chains in Sustaining Diverse Diets in Tanzania.

In Tanzania, there is a large gap between food production and consumption, which contributes to high rates of undernourishment and micronutrient deficiencies. The dietary problems are mainly due to limited dietary diversity among households. Furthermore, increased urbanisation leads to an increase in demand for poultry products which is difficult to satisfy by domestic production. The objective of the current study was to understand the current maize, soybean and chicken value chain(s) and identify important entry points for value chain integration in the Southern Highlands of Tanzania to support nutritious diets. The focus was on these value chain(s) as integrating soybeans in the maize-chicken value chains might increase the productivity of chickens by providing nutrient-dense feed. We carried out an explorative study followed by a multi-stakeholder workshop with 54 stakeholders and experts involved in development of the value chain(s). The current maize, soybean and chicken value chains inter-connected particularly at the levels of the smallholder farming system and at processing facilities. The production of one or more of these products contributes to farmers' food security and income. Poultry feed is an important entry point for integrating the three value chains, whereby maize (grain/bran) and soybean meal are the main sources of energy and protein for chicken, respectively. A small proportion of maize produced is exported to neighbouring countries, while the current amount of soybean produced is mainly marketed in the domestic market. Three systems of poultry keeping were identified in the study area i.e. extensive, semiintensive and intensive systems, with diverse feeding strategies ranging from scavenging, home-made rations, industrial feed rations and combination of home-made and industrial rations. Furthermore, the informal chicken market dominates in both urban and rural location.

Currently, there is inefficient soybean marketing and processing in Tanzania, mainly due to disorganised producer groups and lack of adequate processing plants. As a result, soybean meal is mainly imported and sold at almost three times higher prices than the whole soybean grain produced in the country. Improving soybean production and marketing and investment in soybean processing infrastructures has a great potential to increase local availability of soybean products, reduce the cost of feed in chicken farming, and increase the availability of nutritious animal-based foods for human consumption.