Research Article **ISSN: 2393 – 9540**

International Journal of Nutrition and Agriculture Research

Journal home page: www.ijnar.com

https://doi.org/10.36673/IJNAR.2020.v07.i02.A10

RAISING AWARNESS GOOD PRACTICES WHY AND HOW ON SUSTAINABLE AGRICULTURE IN LIBYA TO REDUCE WATER STRESS AND ENERGY CONSUMPTION

Saleh A. Sadeg[*1] and Khalil Ibrahim Al-Samarrai[1]

[1*]Department of Geological Engineering, Faculty of Engineering, University of Tripoli, Tripoli, Libya.

ABSTRACT

The main water resources in Libya are the scarce and erratic rainfall and the fossil ground water that resides in four major aquifers. Raising and falling demand is stressing supply and coastal aquifers suffering invasion of sea water. Besides, the environmental problems encountered in Libya are the running down of ground water because of overuse mainly in agricultural developments. Agricultural performance in Libya is facing a deficiency of research in policy, its impact and consequence to the development of agriculture. The availability of water in sufficient quantity and adequate quality is a communal matter of high priority and global environmental challenge. In depth analysis of studies recognized during the desk survey conducted for awareness raising, sustainable agriculture and irrigation practiced system in relation to water and energy nexus in Libya detected that irrigation system practiced in Libya (surface irrigation, sprinkler and drip) and its related infrastructures interacted with three environmental elements (water, soil and air), resulting direct environmental impact through (emission, pollution, salinisation and alkalinisation). Another impact arises by interaction with riparian ecosystem and regional areas affecting hosting or threatening biodiversity, recycling nutrients, and mitigating wadi runoff). Awareness raising as organized communication activities should aim to create awareness on topics, behavioral change among the general population and to improve the focus on better outcomes. Promoting awareness among communities shall develop agriculture knowledge-based toward managing water and energy for the sake of sustainability.

KEYWORDS

Libya, Awareness, Sustainability, Environment, Agriculture and Irrigation.

Author for Correspondence:
Saleh A. Sadeg,
Department of Geological Engineering,
University of Tripoli, Tripoli, Libya.
Email: salehsadeg@hotmail.com

INTRODUCTION

Libya classified as an arid country with population of about 6 millions, divided into three zones, the coastal, mountainous and desert (which counts to 90 percent of the total land area) with high temperatures and scarce rainfall. The main water

resources in Libya are the scarce and erratic rainfall and the fossil groundwater that resides in four major aquifers. Rainfall average for Libya is about about 56mm per year. However, raising and falling demand is stressing supply and coastal aquifers suffering invasion of seawater. Besides, the environmental problems encountered in Libya are the running down of groundwater because of overuse mainly in agricultural developments[1,2]. As a result, it is observed a salinity increase and penetration of seawater into the coastal aquifers (Figure No.1).

The economy of Libya could be described as agricultural. Based until the early 1960s, where agriculture contributes about 30% of the GDP[5]. This contribution became 2% by 2007. Whereas, oil contributes 71% of GDP. Libya became an example of twofold economy after the discovery of petroleum[6,7]. Accordingly, Libyan economy remained dependent on oil sector[7]. Moreover, agricultural performance in Libya also face a deficiency of research in policy, its impact and consequence to the development of agriculture[9]. Recently, the influence of land use policies and human factors on the sustainability of agriculture activities carried out in Al-Zawyia, one of the coastal cities of Libya, have been assessed[10].

Therefore, the availability of water in sufficient quantity and adequate quality is a communal matter of high priority and global environmental challenge. In depth analysis of studies recognized during the desk survey conducted for awareness raising, sustainable agriculture and irrigation practiced system in relation to water and energy nexus in Libya detected that irrigation system practiced in Libya (surface irrigation, sprinkler and drip) and its related infrastructures interacted with three environmental elements (water, soil and air), resulting direct environmental impact through (emission, pollution, salinisation and alkalinisation). Another impact arises by interaction with riparian ecosystem and regional areas affecting hosting or threatening biodiversity, recycling nutrients and mitigating wadi runoff).

In over all, the major constraints of sustainable agricultural development in Libya is that water from wells and lakes in Libya face problem of quality due to increase in mineralization as well as the depth of the well necessary to obtain water may vary from few meters to thousands which in turn affect the energy used. The water from wells used for irrigation might lead to accumulation of salts in the soil and hence increasing alkalinity or salinity which then limit crop production. So, managing agricultural resources represent a major challenge as pollution of water and soil arise an environmental problems influence the ability of self restoration of vegetative communities. Besides, low literacy is another factor limiting Libyan agricultural education and form another challenge to awareness strategy as well as to sustaining agriculture. Therefore, it is clear that building public awareness is a vital and important policy to improve community entrepreneurship in order to sustain agricultural resources and productions. Promoting awareness among communities shall develop agriculture knowledge-based toward managing water and energy for the sake of sustainability. Awareness raising as organized communication activities should aim to create awareness on topics, behavioral change among the general population and to improve the focus on better outcomes[11].

METHODOLOGY

As a result of the problems originating in agricultural communities, an adoption of awareness policies have become an essential issue in the development of sustainable agricultural practice to reduce water and energy use in Libya. State of art reviews on research studies carried out internationally and on national scale checked the factors (institutional, demographic, biophysics and socioeconomic) which affect farmers practice to adopt and/or reject innovative technologies. As a basline UN Sustainable Development Goal[11] issued (2014) of "ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality by 2030" was selected.

Two case studies were investigated covering most of the agricultural practices in Libya, one in the eastern part and the other in the Jefara region, where the water situation in agriculture as well as its infrastructural framework was examined[4]. The study referred the problems faced by agricultural practitioners due to the absence of an integrated agricultural policy and lack of collaboration with General Water Authority and other linked authorities. Some issues can be summarized below:

Continuing subdivision of farmland led to drilling new wells, new constructions and cultivation of higher water consuming crops for a quick benefits. The leading factor in this practice is self interest rather than public interest. As a consequence of lack of awareness about the seriousness of water, farmers increase water use in the areas where water resources is restricted and hence increasing energy consumption,

Expansion of irrigation (no matter of the employed system) at the expense of rain fed land,

Desalination plants producing around 48 x 10^6 m^3 desalinated water considered insignificant in proportion to the total demand. In addition the sector did not receive attention to improve or develop its capacity over (1999 - 2009),

Wastewater treatment implemented in Libya since 1970s used for agriculture and protecting environment. However, the area irrigated in 1998 using treated wastewater is about 6000 hectares covering agricultural projects in Tripoli and Benghazi, whereas the development plan of water sector in 2007 - 2020 does not mention making use of the wastewater recycling for any purpose.

The irrigated area increased from 309,258 hectares in 1998 to 901,582 hectares in 2008. This expansion increases water demand from 3259 million m^3 to 3750 million m^3 in 2008 (Figure No.2).

Average water use according to water efficiency standards should be 6293 m^3/hectares/year in Jafara region. The actual average used was 9880 m^3/hectares/year registered in 2007. This discrepancy is an indicator of people unconcern to follow regular irrigation plan.

Current food supply presents an enormous challenge for the local agricultural sector as demand increase due to population growth.

The impact of barriers on agricultural expansion in eastern Libya have been also evaluated[13]. This study examined the practice of 300 farmers and 46 managers and deputy directors resulting in classifying the barriers in to two groups 1. The major barriers of managers and deputy directors of agricultural expansion and 2. The major barriers of farmers. Farmers qualifications and administrative bureaucracy cause a major barriers affecting the adoption of sustainable agricultural development. These barriers become natural challenges to awareness program aiming to set sustainable practice particularly in areas of economic agricultural potential. Another example focused in the western part of Libya examined the performance of private and state farms[14]. The study considered the variation in the chemistry of irrigated water in both farms while the deterioration occurred in soil and water in the private farm. Figure No.3 shows the change in EC and Ca^{+2} in both farms (state and private) in virgin and irrigated soil which reflect the degree of experience practiced in these farms.

Current Employed Technologies

Once analyzed the barriers and problems of sustainable agriculture in Libya, it is clear that actual agricultural practices led to increase in irrigation water salinity and hence soil salinization resulting in crop yields decreased. The results also showed that factors such as; demographic, biophysical, institutional and socioeconomic influenced farmers to adopt, or reject advice[15]. Besides stakeholder involvement as well as capacity development rather than infrastructure should be focused in successful administration[16]. To overcome the problems and resolve the challenges arose from Libyan agricultural practice, an awareness policies must be implemented taking in consideration target 2.4 of the UN SDG No.2. Awareness (theory and application) were reviewed in different literatures issued in the field of sustainable agriculture in order to adopt a suitable strategy that can help solving Libyan agricultural planning for sustainability. To achieve this vision,

the following principles must be well thought-out to guide future awareness raise.

Focusing on knowledge lack for the non-farm and farm community about sustainability and water energy nexus,

Drivers such as demographic and climatic changes further increase the stress on water resources

Relation between water demand and crop production,

Water conditions suitability for different types of agricultural crops,

Enhancing agricultural water efficiency, to help farmers improving their technology used and crop production.

Importance of engaging stakeholders and capacity development in water resources and energy nexus.

Messages to be conveyed can use many different channels, such as mass media (television, radio), social media, public relations, events, talks, demonstrations, tours and leaflets. Should mass media become inefficient in terms of influencing people's attitude and changing their behavior, then it will be essential to know the features of awareness-raising campaigns to establish and develop a successful campaigns in other regions.

Awareness raising initiatives has numerous ways to create the profile of citizens to target[17]. In this work the model adopted to construct awareness program is that given by Enisa (2006) covering the overall approach for executing the program (Figure No.4).

The model has to be set with three phases. Phase one is for plan and assess and Phase two is for execute and manage, while phase three is for evaluation and adjusting.

The adopted model should be under the responsibility of the awareness initiative campaign, who can target users according to the objectives to which the model constructed. In our case the farmers and managers of agricultural projects. The campaign should also be targeted to combine groups such as universities, institutions, non-governmental organizations (NGOs)[17].

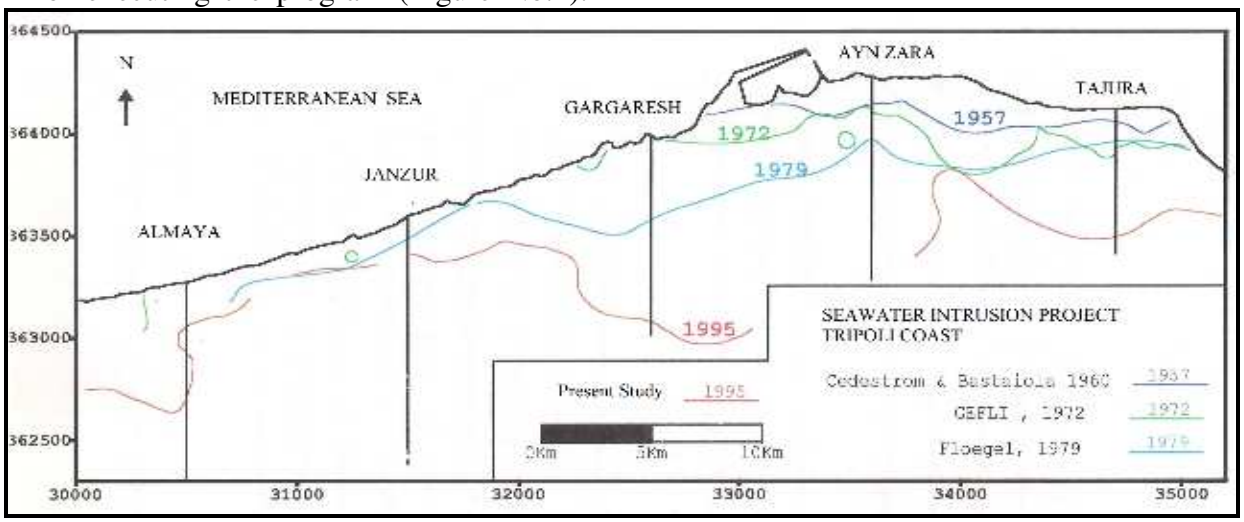

Figure No.1: Advance of saltwater intrusion in Tripoli area due to excessive pumping After Sadeg (1996)[16] and UECO (2002)[3]

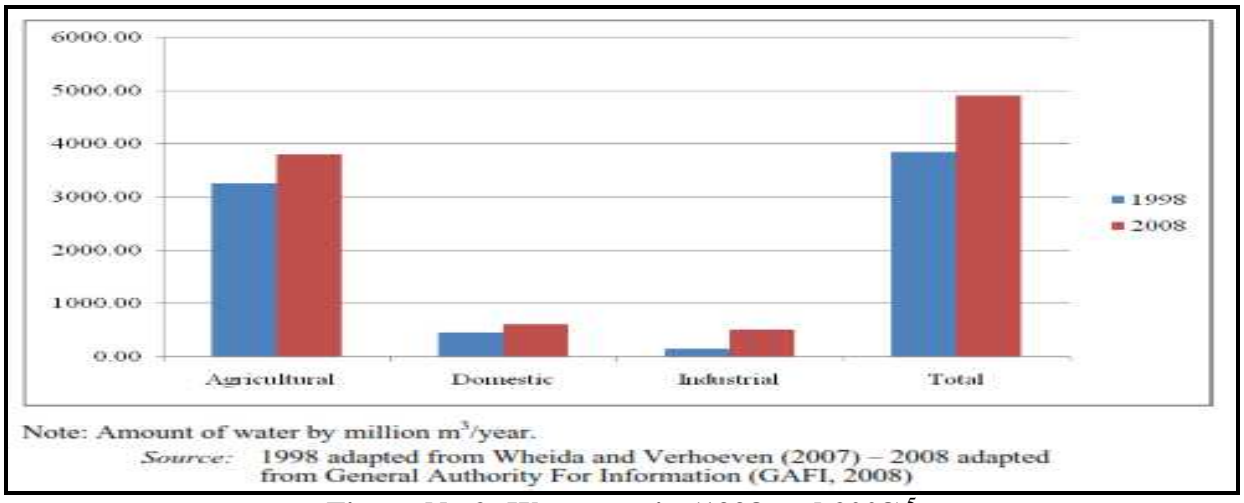

Figure No.2: Water use in (1998 and 2008)[5]

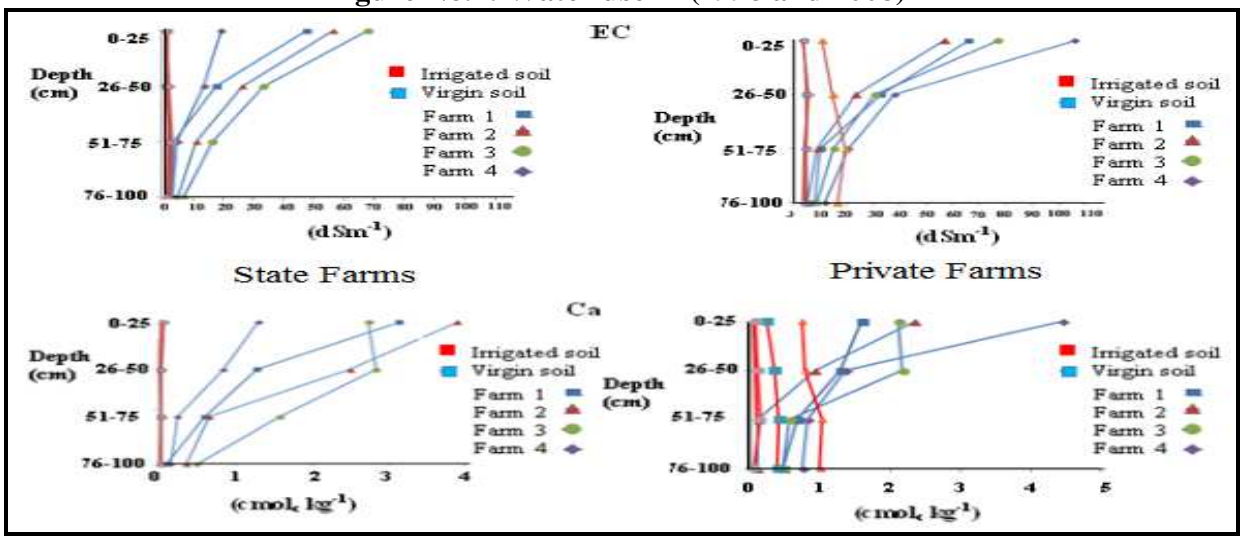

Figure No.3: Depth of soil effects on the pH, EC and Ca^{2+} irrigated and virgin soil from state and private farms[14]

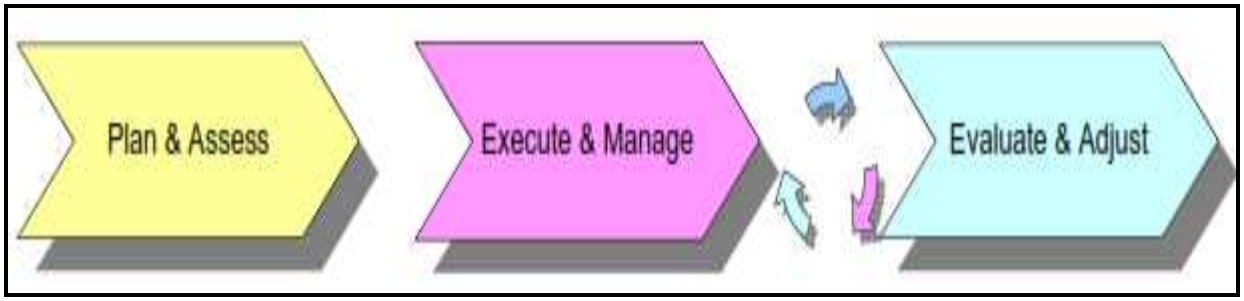

Figure No.4: Overall approach for executing awareness initiatives and programs

CONLUSIONS

The study presents challenges facing water resources and energy due to unsustainable agricultural practiced in Libya and opportunities for enhancing this situation through adopting awareness raising strategies to reduce water stress and energy. Libya has to find ways to construct resilience agriculture practice by using wise and fruitful irrigation systems. The bad irrigation practiced led to groundwater overdraft with water level drawdown and both water and soil quality deterioration. Improvements in irrigation practice depends on knowledge quality of

farmers and managers in agricultural projects in relation to actual and potential crop need for water. However, any effort spend to improve water and energy efficiency need to start with actual and reasonable efficiencies as possible.

RECOMMENDATIONS

However, any effort spend to improve water and energy efficiency need to start with actual and reasonable efficiencies as possible. These efforts must take in consideration implementing an awareness program responsible for improving sustainable agricultural practice to reduce water stress and energy. Three phases were suggested (Plan and Assess, Execute and Manage and evaluate and Adjust) to raise awareness programmes as a strategy in Libyan agricultural planning. Finally and due to that most of planning stay formal without application, it is highly recommended to consider the consequences of inaction are serious and advocates call for an integrated water energy nexus to sustain agricultural practices and productions.

ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to Department Geological Engineering, Faculty of Engineering, University of Tripoli, Tripoli, Libya for providing necessary facilities to carry out this research work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

BIBLIOGRAPHY

1. Bindra S P. Rio. + 20 Libyan National Report, *UNCSD,* 64, 2014, 1-6.
2. General Water Authority, water and energy for life in libya (WELL), *Project Funded by the European Commission,* Grand Agreement Id: 295143, 2014, 129.
3. University Engineering Consulting Office (UECO), Sea water Intrusion Study, North west of Libya, *In Arabic, Project Funded by General Water Authority, Libya,* 2002.
4. Abdudayem A and Scott A H S. Water infrastructure in Libya and the water situation in agriculture in the Jefara region of Libya, *African J. Economic and Sustainable Development,* 3(1), 2014, 33-64.
5. CW. Libya History Index Countries of the World, 2001. http://workmall.com/wfb2001/libya/libya_history_index.html.
6. CW. Government, Countries of the World, 2011. http://workmall.com/wfb2001/libya/libya_government.html.
7. Allafi K and Mousa A. The impact of changing agricultural policies on Libyan agricultural performance, *Doctoral, Sheffield Hallam University,* 2014, 1-283.
8. Azzabi T. Food self -suff iciency and agricul tural research in Libya, *Cahiers Options Mediterraneennes,* 1(5), 2001, 77-79.
9. Elawama, Ahmed Salem A B. The influence of natural and human factors on the sustainability of agriculture in azzawia Libya, *Thesis, University Sains Malaysia,* 2016, 1-24.
10. Laura Masiuliene, Janet Looney, Hanne Aertgeerts and Maurice De Greef. The key features of successful awareness raising campaigns, european literacy policy network (ELINET), *Lifelong Learning Program,* 2016, 1-13.
11. UN Sustainable Development goals issued, global indicator framework for the sustainable development goals and targets of the 2030 agenda for sustainable development, 2014.
12. Jadalla A E, Omar, Abu Hassan Abu Bakar, Hasnah M D, Jais and Faisal Moftah Shalloof. The impact of major constraints on agricultural extension in eastern Libya, *Journal of Agricultural Technology,* 8(4), 2012, 1171-1183.
13. Aiad A. Akhreim Aboeltiyah Alzway. Water quality problems in irrigated agriculture in Libya, *Thesis, University of Glasgow,* Corpus Id: 130694833, 2015, 242.
14. Nelson Mango, Clifton Makate, Lulseged Tamene, Powell Mponela, Gift Ndengu. Awareness and adoption of land, soil and water conservation practices in the Chinyanja

Triangle, Southern Africa, *International Soil and Water Conservation Research,* 5(2), 2017, 122-129.

15. Avellan T, Ardakanian R, Perret S. R, Ragab R, Vlotman W, Zainal H, Sangjun I M and Gany H. Considering resources beyond water: irrigation and drainage management in the context of the water- energy-food nexus, *Published online in Wiley Online Library,* 67(1), 2017, 12-21.
16. Sadeg, Saleh, 1996. Numerical Simulation of Saltwater Intrusion in Tripoli, Libya. Ph D thesis, Middle East Technical University, Ankara, Turkey.
17. Enisa. A user's guide: How to raise information security awareness, *European Network and Information Security Agency,* 2006, 3-64.

Please cite this article in press as: Saleh A. Sadeg and Khalil Ibrahim Al-Samarrai. Raising awarness good practices why and how on sustainable agriculture in Libya to reduce water stress and energy consumption, *International Journal of Nutrition and Agriculture Research*, 7(2), 2020, 72-78.