

## Kuwait's agricultural efforts to mitigate climate change

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### Abstract

Kuwait's agriculture is constrained by harsh arid environmental conditions which limits the range of crops that can be cultivated. Hence any significant expansion in open field agriculture can be done by giving emphasis on selection and adaptation of crop plants that can withstand the adverse climatic conditions. Since adaptation to climate change is imperative for Kuwait, it should be the central element while developing planning strategies of the country. Kuwait Institute for Scientific Research (KISR), a pioneer in the field of agriculture has undertaken many projects with the objective of contributing to integrated crop production and management of natural resources in a sustainable manner. These projects aimed at developing new varieties of crops adapted to high temperatures and different spans of seasons and also crops resistant to salinity and drought. KISR has introduced more than 50 trees for greenery and landscape beautification under the Agriculture Master Plan. Those trees are being used for greenery purpose and to reduce climate change effect. In addition the Public Authority for Agricultural Affairs and Fish Resources (PAAFR) has also introduced some ornamental trees to Kuwait such as *Conocarpus*, *Ficus*, *Prosopis* and date palm trees to combat climate change. The continuation of efforts to minimize climate change is crucial for which coordination between institutions and programmes needs to be improved.

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## 1. 1. Introduction

Being an arid country, Kuwait faces several challenges and constraints to sustainable agricultural development. The climate of Kuwait is characterized by very low annual rainfall and high degree of aridity. In addition, there are problems resulting from the degradation of natural resources due to salinity, water logging and desertification. Above all, the open areas suffer from exploitation of vegetation and over-grazing pressures which accelerates soil erosion, affects biodiversity and has resulted in a decline of the indigenous and perennial plant species. Since the production technologies are being adopted without considering the soil and water characteristics of Kuwait, rise in groundwater table, groundwater pollution and degradation in the productive capacity of soil occurs which in turn affects plant productivity. Such practices present a threat to the environment and sustainability of agricultural production in Kuwait (Omar, 2004). Under the peculiar climatic and soil conditions in Kuwait, any significant expansion in open field agriculture can be expected only if a major emphasis is focused on selecting and adapting crop plants that can tolerate the unfavorable climatic conditions of Kuwait.

The combined effects of aridity and soil salinity limit the range of crops that can be cultivated in Kuwait. Since adaptation to climate change is imperative for Kuwait, it should be the central element while developing planning strategies of the country. Kuwait Institute for Scientific Research (KISR), a pioneer in the field of agriculture has undertaken many projects with the objective of contributing to integrated crop production and management of natural resources in a sustainable manner.

In the new strategic plan KISR aims at developing modern agricultural technology to improve production performance of promising crops. The projects at KISR aimed at developing new varieties of crops adapted to high temperatures and different spans of seasons and also crops resistant to salinity and drought. KISR has introduced more than 50 trees for greenery and landscape beautification under the Agriculture Master Plan. Those trees are being used for greenery purpose and to reduce climate change effect. In addition, the Public Authority for Agricultural Affairs and Fish Resources (PAAFR) has also introduced some ornamental trees to Kuwait such as *Conocarpus*, *Ficus*, *Prosopis* and date palm trees to combat climate change.

To cope with the impact of climate change on agriculture, careful management of natural resources is essential. Hence, agricultural systems must be made sustainable with integration and coordination of livestock and crop production to deal with climate change. Also, concerted efforts must be taken to ensure the productivity of land for the future and the inputs provided should be safe for the farmer, the consumer as well as for the environment.

## 1.2. Climate Change and Kuwait

Adaptation is one of the promising ways to reduce vulnerability of climate change not only in Kuwait but all around the world. In the UN Economic Affairs Committee, the State of Kuwait has urged the international community to devise strategies to minimize the impact of climate change. The State of Kuwait also seeks to preserve its environmental and ecological diversity through the establishment of the Environment Public Authority (EPA), which aims to devise national strategies to preserve Kuwait's ecological diversity. Other national institutions are also actively involved in research in the field of biological diversity, such as the Kuwait Institute for Scientific Research (KISR) and the Public Authority for Agricultural Affairs and Fish Resources (PAAFR). Kuwait has also achieved remarkable accomplishments in the creation of natural reserves, establishment of breeding programs for rare animal species facing extinction, and its establishment of cattle farms, laboratories and centers for grain technology.

Significant researches have been conducted at KISR to mitigate the effects of climate change focusing on adaptation of both crop and ornamental plants to heat, drought and salinity in addition to studies on water use efficiency. The irrigation water sources in Kuwait are scarce and depend on desalinated seawater, brackish ground water and treated sewage water. Research in arid horticulture must aim in the development of sustainable agriculture by combating the adverse climatic effects. Considerable efforts have been made by KISR and studies were conducted for the introduction of new crop varieties with tolerance to abiotic stresses, development of new agricultural technologies and practices including water management, post-harvest technologies and marketing, which will play an important role in molding the farmers in adapting to climate change.

The major research activities undertaken at the Food Resources Division (FRD) at the Kuwait Institute for Scientific Research (KISR) include animal production (sheep, poultry and cows), plant production (protected and open field), soil sciences, irrigation water and native plant cultivation and wild-life conservation. Under the section aqua-culture, fisheries and oceanography the projects such as development of technologies for aqua-culture of fish and shrimp, analysis of fish feed and nutrients, intensive production of fish fingerlings, evaluation and sustainable exploitation of fisheries resources and study of oceanographic parameters affecting fisheries were studied.

Major studies conducted at the Arid land Agriculture and Greenery Department (AAD) at KISR include Development of Salt Tolerant Barley for Sustainable Agriculture in Kuwait, Evaluation of Barley and Wheat Performance under Kuwait's Growing Conditions (ACSAD), Selection of Crops for Salt Tolerance, Selection of Salt-tolerant Ornamental Plants, Evaluation and Improvement in *Zizyphus* for

Landscape Beautification and Fruit Production in Kuwait , Selection of Olive Varieties for Greenery and Fruit Production in Kuwait: Phase I, Forest Fire Management, Promotion of Agroforestry, Adaptive Management with Suitable Species and Silvicultural Practices, Introduction of Flowering Trees of the Genus Cassia for the Enhancement of Greenery in Kuwait, Phase I: Introduction and Evaluation, Introduction, Evaluation and Propagation of Argan Tree for Greenery and Oil Production in Kuwait, Phase I: Introduction and Propagation, Testing of Closed Production System for Controlled Environment Agriculture, Sub-irrigation System for Protected Cultivation, Application of Polymer Membranes to Conserve Irrigation Water and Weed Control and, Study on Efficiency of Barley and Wheat Genotypes under Kuwait's Conditions.

Among the 1230 promising lines of crops such as barley, cabbage, cauliflower, garlic and onion tried for salt tolerance, 220 lines were tolerant in GH and 74 lines were found to be promising lines in FD. Regarding their yield performance, yield of barley variety IG 33000 was higher in BW (45.23) compared to those in FW (34.80). Regarding the evaluation of different *Zizyphus* varieties, different selections were tested under different saline concentrations and at 20 dS/m Thailand Selection performed well compared to others. Among the different ornamental crops tested, *Allamanda cathartica* performed well at 5.0 dS/m compared to *Peltophorum ferruginum*, *Thespisia populnea*, *Ficus pumila* and *Duranta plumeri*.

### 1.3. Conclusion

The projects conducted at KISR played a significant role in developing strategies for implementation of modern technologies to mitigate the unfavorable effects of climate change and may help in formulating recommended ways to adopt sustainable agriculture. The continuation of these researches is crucial to improve environment and crop production with good quality and high yielding. In addition, development of linkages between KISR, PAAFR, Farmers' Union, and other GCC countries is pertinent in mitigating climate change in Kuwait.

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