

The Status and Prospects for Agriculture in the United Arab Emirates (UAE) and their Potential to Contribute to Food Security

Saif Al Qaydi*

Geography and Urban Planning Department, UAE University, P. O. Box 15551, Al Ain, United Arab Emirates

Abstract: This paper focuses on the status and prospects for food production in the United Arab Emirates (UAE) and the government's role in sourcing food to feed its people. Food security is an international issue even for those countries that have fertile soil, adequate water, and a skilled farm labor force. This is evident in the UAE, with its harsh environment, limited water resources, and infertile soil. In recent years, and as a result of the mega-development in its infrastructure and its economic activities, the UAE received more than eight million people from more than 200 ethnicities worldwide. They have not only been seeking better jobs and better life, but also with the intention to settle permanently. Their growth in the UAE population alerted the government to look for alternatives to increase food supplies other than from imports. Focusing on its local farms, and exploring the suitable new farming techniques, will bring more prosperity to the farming sector in the UAE.

Keywords: Food security, Farming techniques, Geography, Environment.

INTRODUCTION

The population of the UAE increased in recent years from 1.5 million in the 1970s to more than nine million in 2014. This increase came as a result of its open market policy that enabled several companies around the World to open new branches to their businesses in the UAE to be close to their markets. The Federal government was viewed as providing a healthy business environment that resulted from government's transparency and business legislation. The geographical location between the Indian-Sub-continent and the Far East, plus other Gulf and Arab countries, made the UAE a hub for international passengers and merchants to explore the country's opportunities and eventually it became one of their main destinations. Overall, its modern service infrastructure, particularly its seaports and airports, enabled the UAE to build an international reputation for its cities, most notably Dubai, as dynamic and forward-looking. Incentives for business led large numbers of workers to come from all over the World to work in the country. This added more pressure on the limited internal food production available in the UAE, and raised the annual bill for imported food to more than AED 41 billion (US\$1.5 billion).

This paper examines current UAE food security policies and perspectives on domestic food production, processing, and distribution. Furthermore, it will suggest possible future scenarios, including the crucial matter of the feasibility for UAE investment in domestic

agricultural productivity in relation to a strategic focus on reducing necessary quantities and qualities of staple foodstuffs from overseas. In addition, the paper presents the UAE government's efforts to make food available to its people from local markets and importing small quantities from overseas markets with high quality and affordable prices. It evaluates the current UAE food supply and government roles in increasing the quality of farm crops grown on UAE soil. The study sheds light on the governmental efforts to use new techniques to increase productivity of its farm crops in the country. This research hypothesizes that a domestic strategy is most appropriate and feasible to produce larger quantities and higher quality of food within the context of its global and domestic political, economic, and environmental conditions. Data used in this research have been retrieved from original governmental statistical abstracts and the latest available secondary sources.

Several studies have been conducted to identify the different food production problems in the Arab World in general and the UAE in particular. Indeed, few research papers concentrate on the UAE government efforts to increase food production. Studies by Marie [1], Feller [2] and Cleaver [3] focus mainly on obstacles to crop production in Northern African caused by water shortage. Richards [4], Honey & Abu Kharmeh [5], Al-Kibsi [6] and Akhtar [7], used historical backgrounds as baselines to predict potential future problems in supply and demand in the Arab World. Two studies with specific reference to the UAE Abdu Salaam [8] and Al Qaydi [9] tried to evaluate food production issues in the UAE, especially the possibility of using new techniques and modern tools to grow farm crops in controlled environments. These papers cited advice from

*Address correspondence to this author at the Geography and Urban Planning Department, UAE University, P. O. Box 15551, Al Ain, United Arab Emirates; E-mail: Alqaydi@uaeu.ac.ae

available agricultural experts, with a view to supply the local markets with organic fresh food. The study by Al Qaydi [10] discussed the possibility of growing food on rented farmland in other friendly countries that subsequently would export the product to UAE markets. Most of these studies examined economic cooperation between producing countries and those that import food. Additionally, most of these scholars evaluated recent environmental and agrarian crises facing many UAE food supplying regions, for example Russia, Australia, South, Southeast and East Asia, and their impact on the World food supply. These concerns affect both Gulf Cooperative Council Countries (GCC), and the entire Southwest Asia and North African (SWANA) region, which share similar conditions to the UAE. Increasing global and regional demand, exemplified by rice, a mainstay of the UAE diet, and unstable supplies caused by competition between other countries affect world price stability with particular impacts on the rice-consuming SWANA populations. This current study draws attention to the UAE's significant reliance on foreign food sources and recommends the best course of action to resolve its food security.

GOVERNMENT ALTERNATIVES

Increased population growth influenced the government to search for other alternatives to provide food for newcomers. The main three scenarios for food acquisition in the UAE are: 1) import food from international food markets, 2) rent farmland and grow food in other countries including Sudan, Vietnam and Pakistan, and import it to the UAE markets, or 3) focus more on growing its own food, which forms the core of this paper. The UAE's geographical location in an ultra-arid climatic zone with limited areas of fertile soil is not conducive to significant increases in agricultural activity. The UAE, therefore, is still far from reaching self-sufficiency in food production, and is unlikely to do so.

DOMESTIC PRODUCTION: MAXIMUM NUTRITION FROM SCARCE RESOURCES

Continuity and stable international relations are equally important as quantity when developing trading partners. An essential portion of the equation is quality in both domestic production and international imports. Nutritional value of foodstuffs involves more than agricultural practices; it includes, proper storage and handling, timely transport, and marketing, It is often forgotten that minimum daily requirements for human

health involve more than the quantities consumed, but entails the desired combination of nutrients derived from food. Therefore, the UAE government's food security policy needs to promote scientific principles regarding nutritional intake of the population in relation to total foodstuff availability from any sources.

Perhaps such a scientifically sophisticated strategy may not be receptive by people in a consumer society where junk foods are as readily available as healthy food. However, nutritional information and education are making their way into society through government promotional efforts. This is exemplified by the Abu Dhabi Educational Council (ADEC) policy to ban junk food and enforce healthy diets in all school lunches and snacks. Unfortunately, social values will take a long time to change since the UAE has already entered into a global consumer society. International fast food chains with sophisticated marketing and constant and easy access to global food and beverage imports are currently widespread in the UAE.

CLASSIFICATION OF UAE MAIN FOOD SUPPLIERS

The UAE has a food supply network that spans the globe (Figure 1). Already unable to supply domestically its meat consumption, the UAE currently imports meat from as far a field as Brazil, Australia and New Zealand [11].

As one of the main suppliers of live animals and animal products to the UAE, India exported a total of 1.6 billion kilograms of meat worth AED four billion (one USD equals 3.67 AED) to the Emirates in 2013. Australia was second that year when it exported 953 million kilograms of meat worth AED 2,3 billion. In term of meat, in 2013, Brazil ranked first among the top ten countries exporting live animals to the UAE market, while India was among the leading countries exporting meat to the UAE (Table 1).

The neighboring country of Oman was the leading country to export other animal product e.g. fat and oil.

In 2013, China was identified among the leading countries that export dairy and other animal product that totaled 70 million tons. India and Pakistan are the primary Asian countries supplying UAE markets with vegetable products. Combined they sent more than 140 million tons of vegetables and fruits to the UAE markets that were worth approximately AED 1.2billion in 2013 [12]. In addition, that same year, the UAE imported a total of two billion tons of vegetables with a



Figure 1: UAE main food imported countries in 2014.

Source: Data collected from www.economy.ae

Table 1: UAE Main Imported Animal Products in 2013 in Kg

imported live animals (Km(in Kg)			Other animal products		
1	BRAZIL	281,678,355	1	OMAN	6,260,038,450
2	SAUDI ARABIA	222,129,220	2	SOUTH AFRICA	2,433,547,461
3	NEW ZEALAND	107,454,699	3	IRAN	2,071,016,957
4	OMAN	93,424,412	4	BRAZIL	1,991,478,531
5	INDIA	91,471,301	5	JAPAN	1,649,953,452
6	USA	90,408,548	6	SAUDI ARABIA	1,510,913,768
7	NETHERLANDS	68,950,351	7	INDIA	1,047,985,818
8	AUSTRALIA	62,078,994	8	SWEDEN	759,337,594
9	PAKISTAN	34,359,148	9	KUWAIT	726,398,844
10	FRANCE	27,769,485	10	CHINA	541,418,187
Imported meat (in Kg)			Dairy Products (in Kg)		
1	INDIA	1,618,632,019	1	Group of Free Zones	407,579,595
2	AUSTRALIA	952,574,197	2	INDIA	204,492,552
3	USA	865,701,750	3	SAUDI ARABIA	144,146,857
4	SPAIN	689,156,041	4	THAILAND	123,279,240
5	PAKISTAN	637,304,815	5	USA	116,017,358
6	ARGENTINA	543,626,618	6	NETHERLANDS	86,688,653
7	CANADA	520,968,864	7	PAKISTAN	76,238,175
8	IRAN	514,508,634	8	FRANCE	72,307,734
9	ITALY	343,497,146	9	TURKEY	71,281,470
10	SOUTH AFRICA	276,150,094	10	CHINA	70,900,164

Source: UAE Ministry of Economy, 2014 and the UAE National Bureau of Statistics, 2014.

market value that exceeded AED 18 billion; however other global food imports are cutting into the India-Pakistan share. Increasing amounts of fruits and vegetables come from China. India and Pakistan which are located in close proximity to the UAE, and therefore

have easy access via the Arabian Sea and Oman Sea. They have long been regional trade partners. It is common to see several hundred large dhows transporting vegetables and other foodstuffs from these two countries for delivery to UAE markets (Figure 2).



Figure 2: Dubai Creek crowded with Dhows carrying food stuffs from neighboring countries.

The need for animal or vegetable fats, oils and wax products in the food processing industries, as well as for domestic consumption, is significant. The UAE imports these from both regional and global suppliers. Staple cooking oils and fats, such as ghee and olive-oil, coconut palm and seed oil, can be obtained from a regional zone extending from the Mediterranean to the Indian Sub-Continent and East Africa, but may be obtained from more distant sources. The UAE also imports these from Malaysia, Argentina, and the USA. This accounts for approximately 80% of all such imports to the UAE.

THE FOOD INDUSTRY IN THE UAE AND ITS GEOGRAPHICAL DISTRIBUTION

In 2013, there were 2,563 establishments operating in food industries in the UAE. Among these are 1,641 establishments in the bakery industry, that represent 64% of the total UAE establishments in this business. Cocoa and chocolate manufacturing was second with 13.6% of the total in food manufacturing. This can be explained as a life-style requirement, and in some nations it represent modernization of the standard of living. In addition, cocoa and chocolate are used in some other manufacturing products. Unfortunately, only one establishment was engaged in vegetable processing. This is inadequate for the needs of the UAE (Table 2).

Data indicate that Dubai has almost half of all the UAE's food processing establishments with 48%, followed by Sharjah 19%, and Ajman 13% (Figure 3).

These three Emirates combined host more than 80% of all food manufacturers in the UAE. They are located in close proximity to each other and represent the UAE's main food manufacturing triangle. Most of the labor force working in Dubai's food establishments resides in Ajman and Sharjah because the cost of rental accommodation is much cheaper in these two Emirates than it is in Dubai. Dubai's industrial strategy and modern infrastructure are considered to be decisive locational factors and as international safe havens for several companies that have invested in the Gulf Region, namely: Nestle, Foodco Holding, International Fish Farming, United Food and Starbucks. Dubai's two modern airports and the two internationally recognized free trade zones of Jebal Ali, Dubai Airport Free Zone and the Silicon Oasis Zone enable several international food companies to establish their businesses in this area. Nevertheless, Abu Dhabi is the largest Emirate in area and population, but it concentrates more on oil reserves and the Petro-chemical industry than the food industry.

TAKING ADVANTAGE OF FARMING SEASONS

Seasonal differences between the Northern and Southern Hemispheres, and their relevance to specific food availability, enable the UAE to import food, especially vegetables, fruits and cereals, throughout the year. During the UAE Summer, the Indian Sub-continent is the region of choice for importing fruits and vegetables being harvested at that time, while during the UAE winter, food is imported from Australia, South

Table 2: Total Number of Establishments in Food Manufacturing in the UAE 2013

Number of establishments	Economic activities
136	Processing and preserving of meat
118	Processing and preserving of fish, crustaceans and mollusks
54	Processing and preserving of fruit and vegetables
1	Manufacture of vegetable and animal oils and fats
22	Manufacture of dairy products
91	Manufacture of grain mill products
4	Manufacture of starches and starch products
1641	Manufacture of bakery products
56	Manufacture of sugar
348	Manufacture of cocoa, chocolate and sugar confectionery
5	Manufacture of macaroni, noodles, couscous and similar farinaceous products
74	Manufacture of other food products n.e.c.
13	Manufacture of prepared animal feeds
2563	Grand Total

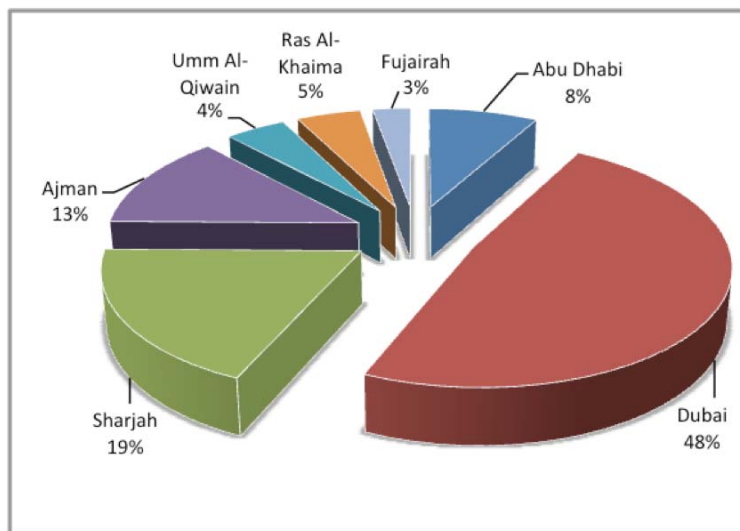


Figure 3: The distribution of UAE food manufacturing, 2013.

Source: Ministry of Economy.

Africa, and South America. Thus, climatic differences play a significant role in the pattern of food imports supplied to the UAE. In recent years, the UAE’s Minister of Foreign Affairs has visited several countries to explain the UAE’s economic policy and thereby to gain increased support for future trade.

This seasonality has a resultant impact on cost of imports. In 2013, the UAE imported more than 1,7 billion tons of live animals and animal products from neighboring Saudi Arabia worth more than AED 2.8 billion. The import costs were greatly reduced by close

proximity, which allowed the products to be transported relatively short distances over land in trucks. However, in the same year with a cost of AED 1.6 billion, the UAE was only able to import 96million tons of live animals (to be butchered in the UAE during some Islamic and local occasions) and other animal products from Australia owing to transportation costs over the vast distance. This resulted in a cost of approximately AED 11/ton to the UAE. By contrast, India’s West Coast is only 2000 km away and therefore over the same period, the UAE imported 1.1 billion tons of live

animals and animal products from India at a cost of only AED 1.8 billion. Even with the cost difference, the UAE still imported from Australia to answer the local market demands for the Australian meat. Import decisions are further influenced by competitive markets, fluctuating currency exchange rates, available transportation, and diplomatic relations with trading countries. In general, business strategies and well-written regulations play a major role on UAE importation of food from international markets [13].

UAE DOMESTIC FOOD POLICY: GOVERNMENT SUPPORT

The UAE's agricultural policy reflects a determination to produce its own food in spite of the harsh climatic conditions, water shortage, and limited extent of fertile soil. This is part of the UAE's commitment to ensuring food security. The government, especially the Emirate of Abu Dhabi, occupies 85% of the total UAE land, and continues to distribute farmland to its local citizens with no charge. In addition, the Ministry of Environment and Water (MEW), which replaced the Ministry of Agriculture and Fisheries, plays a major role in monitoring these farmlands. As part of the government strategy to encourage the farming sector at the federal level, the MEW continues to support the UAE farmers by paying 50% of the costs of farming supplements, e.g. fertilizers, pesticides and improved seeds [14]. Several new farming techniques are in the experimental stage and show promising results, but they have not yet been applied on a commercial scale. Also artificially cooled greenhouses have been used in some farming regions in the UAE with good results.

The government of Abu Dhabi has established collection stations to enhance the farmers ability to continue practicing farming activities. At these points farmers can deliver their crops to be marketed for the highest price using the governmentally own distribution centers. The government also gives incentives to attract new farmers to begin farming, since without these incentives, many may not be receptive to invest in developing farms. This is attributed to the limited profits and the high cost of reclaiming land and implementing modern farming technology. In an effort to improve farming methods, the government has also built educational institutions offering study in agricultural engineering.

Having outlined the overall picture of UAE food security policies that encompass domestic and

international factors, the focus now turns to a more specific analysis of internal sources for UAE food security. This entails a feasibility of investments in diversifying and increasing production from domestic or other sources. For example, the UAE government and private sector direct some of their investments to growing crops in the UAE farming regions. The Arab Authority for Agricultural Investment and Development (AAAID) fosters this co-operation. The UAE is one of 20 AAAID member countries. The AAAID has its headquarters in Dubai and controls a total investment capital of US 283 million (AED1,038.6 million) [15]. In 2014, the AAAID operated only three agricultural companies in the UAE that deal with livestock and dairy. There is considerable latitude for the UAE government and the private sector to develop new agricultural ventures should they wish to put forward proposals for funding from the AAAID. Equally, there are opportunities to conduct evaluative research into existing farming projects and soil science associated with UAE farmland.

AQUACULTURE AND HYDROPONICS POSSIBILITIES

Two recent new projects have had dramatic impacts on agricultural productivity and water conservation in Abu Dhabi. The initial aquaculture project has already proven efficient in both categories. By combining aquaculture, better known as fish farming, with hydroponics, a closed-loop ecosystem is created, with the fish fertilizing water that nurtures the plants. In the Emirate of Abu Dhabi, The Beniyas Center project includes two 400,000m² greenhouses with an estimated production of 200 tons of Tilapa fish and 300,000 heads of lettuce annually. Future systems are designed to expand the output of other vegetable produce. Water concerns are mitigated by a unique solar driven pump that recycles 400,000 liters over a one-year period with minimal resupply [16]. This virtually closed system will be closely observed by other arid countries.

Like many other innovations in Abu Dhabi, notably from the Masdar institute, which is pioneering a carbon neutral city of 20-40,000 residents with solar energy technologies, the Zayed Higher Agricultural Centre for Rehabilitation and Development plans to replicate Aquaculture projects across the country. While the projects are based on existing technologies proven efficient in the Caribbean for over 10 years, the projects are the first to be developed in a desert environment [17]. Another innovative agricultural project in Dubai's

Al Awir region using straight hydroponic technologies has reduced water consumption by 60-70% when growing cucumbers.

A similar project in Al Ain's Al Dahara agricultural zone has installed underwater controlled irrigation in addition to more traditional surface drip irrigation. This has reduced water consumption by over 75% and with a corresponding 50% reduction in fertilizer. In the Northern Emirate of Sharjah, the Khor Fakkan area has begun to experiment with similar systems because of highly saline water entering many wells, Estimates indicate that date palm subsoil irrigation should save between 50% and 80% of water consumed [18]. It is premature to evaluate the economic value of these projects, but all these experiments could lead to a sustainable food supply to the UAE markets and, at the same time could lead to a reduction of the water consumption in the agriculture sector.

WASTED FOOD/HEALTHY FOOD

Overall nutritional value in foods consumed is also an issue that needs enormous amounts of public education to shift gradually the food consumption patterns of the UAE, especially in reducing fats and sugars that are known to lead to higher rates of diabetes, one of the most serious UAE health problems.

In general, the Gulf Cooperation Council nations are considered as one of the top regions in creating food wastage. According to a report issued in 2009 by the Abu Dhabi Waste Management Centre, one-third of the UAE's total waste comes from food remains [19]. Recycling much of that waste for animal feed and composting would offer a partial solution. In Dubai 38% of the daily consumed food is wasted, while in Abu Dhabi 33% of waste generated each year is food [20]. Many solutions have been inaugurated in other countries, including portion control in restaurants, institutional kitchens, and households that focus on producing nutritionally complete meals, which provide the suggested daily calorie requirements for individuals and public health.

Food consumption in the UAE has gone from marginal to opulent. A scant 50 years ago poverty and limited resources governed consumption of food. Although malnutrition was often present, the dangers of obesity-linked ailments such as cardiovascular and diabetic diseases were absent. As international health experts have warned about the dangers of falling into

the trap of a fast food consumer society, UAE governing authorities have begun to move in the right direction of healthy food awareness, in schools, homes, and restaurants. One new strategy involves food labeling in both Arabic and English, with nutritional information on the product. A recent initiative in assessment, coupled with educational and governmental intervention in information and active change, was triggered by results from a massive health screening of children at Abu Dhabi public schools. This has revealed two thirds of the students have decaying teeth, almost half are overweight, and one third are anemic [21]. Problems thus appear in a wide range of dietary practices, in which caloric intake quantity may be overabundant, but nutritional value is under represented. In March 31 2015 the UAE Prime Minister Sheikh Mohamed Bin Rashid led a health march in Abu Dhabi to encourage young generations to live a healthy life by monitoring their sporting activity and daily food consumption [22].

It is evident that food security involves not only production, supply, transport, food handling and management, but also quantity and quality of consumption at the end use of the supply chain. Government needs to continue promoting a new culture of healthy and modest eating habits in the UAE. However, in advanced economies currently undergoing a stark wakeup call from the global financial crisis, organizations have begun food salvage programs. These promote salvaging waste food from restaurants and supermarkets for public soup kitchens and charitable feeding projects. This is condensed with the Three R's; *reduce, recycle, and reuse*. Among these the former is most advantageous.

PROMISING FUTURE AQUACULTURE

It is important to establish research laboratories where agricultural engineering students could experiment with new production to achieve increased farming output, e.g., the development of superior seeds. Farming methods that utilize a reduction of water, and include progressive farming techniques that enhance yields may contribute to a two crop per year harvest. This would help to resolve some of the supply and demand in the country.

In its search for alternative food sources, and in line with striving toward greater self-sufficiency, the UAE government could capitalize on its two coastlines, Arabian Gulf and the Oman Sea, to develop varied forms of aquaculture. Ranging from coastal fish and

shellfish farming, to deep-water fish resource management, the government could control the reduction and over harvesting of other marine food sources. Already the popular Hamour species has neared the point of being over fished and thus threatens the population dynamics with possible extinction. This has prompted government conservation action resulting in more regulation of fish stocks.

The rural-urban divide is already breaking down in many advanced economies with multiple reasons for greening dense urban zones and planned suburban development. This reduces automobile traffic and integrates productive micro-agriculture with public and private gardens. The UAE government has concentrated considerable effort on research and development into designing urban green zones and vertical urban agricultural. They have encouraged the use of technology in a similar manner as Holland by promoting urban high-rise greenhouses for local food production. People could grow crops that consume less water and do so by using greenhouse construction. The government could also utilize the UAE's 78 universities, colleges, and other higher educational institutions to provide instruction to people choosing to develop food production.

GOVERNMENT SUPERVISION

Currently, the Federal Government, represented by the MEW, is the main federal agency monitoring farming activities in the UAE, yet concurrently, there are several local agencies dealing with the farming activities in individual Emirates. For example, in the Emirate of Abu Dhabi there are several agencies operating in the agricultural sector. First, the Department of Farming and Livestock operates in the Al-Ain farming region and the Abu Dhabi Municipality. Second, the Farmer Services Center is supporting innovation through seed programs, while the Abu Dhabi Municipality manages agriculture in Abu Dhabi and the Western Region farming zones. This may create conflict when it comes to applying a single, national farming policy across the board for all of the seven Emirates.

In general, all these agencies are working well to promote and develop the farming sector in their specific capacities. For example, in Abu Dhabi, the government aimed to reduce the water consumption for farming activities by 40% before 2016 as part of the government's agricultural policy to modernize agriculture in the UAE. As a result, on 10 August 2010,

the newest experimental farms in the Emirate of Abu Dhabi were put into operation using the latest farming technology. A purpose of these farms is to serve as models for other farms in the area. This should facilitate more modern and highly efficient farming practices in the area [23]. This strategy is not limited to food production on land, but it will also encompass marine food sources as well.

CONCLUSION

It is clear that no country can be entirely and permanently self-sufficient in all basic food requirements; nonetheless, countries can strive to produce sufficient quantities of food to feed their people over limited periods during an emergency [24]. The foregoing suggests that the UAE's future food strategy should focus more on domestic farms, improvement of the local farming environment, use of proper farm technology and techniques to support growing crops that are best suited to arid climatic conditions.

In addition, the open policy of farmland distribution allows for the accrual of farmland to non-farmers as well as farmers. Yet this may result in some farmland limitation for future governmental projects to be expanded. Furthermore, it could lead to a major water irrigation problem in these areas. Ignorance of good farming practice has exacerbated soil and water problems because untrained people lack the knowledge and experience required to apply accepted and responsible farming methods that are guaranteed to produce long-term gains with minimal negative environmental impact. Most of the recent farm owners who have just acquired farmland use outdated and ineffective methods of farming which consume large quantities of water and cause soil salinization. Other owners who are from a non-farming background use the farmland they have been given as a recreational center for their weekend pleasure pursuits and not to produce food for local markets.

The government may need to increase its efforts to all UAE farmers to convince them to implement new farming techniques and to market at the government establishing selling centers, as it practiced in Abu Dhabi farming areas. The government should also consider introducing a new law for the newcomers to have an organizational plan for the total number of their family members similar to China and other parts of the World.

With the recent situation in world food supply and global environmental changes in some major UAE

import countries, the UAE could pay greater attention to its local farm sector by establishing more farming centers and allocate more research funds for water and farming studies. In the meantime, food imports will continue to grow until the local farming industry is better developed.

Finally, the government could direct its research resources to be invested in food research and food manufacturing. The frozen vegetable sector could be developed in the country by investing heavily in greenhouse-based farms and freezing equipment to produce vegetable where this product could be sold locally and other GCC countries.

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Received on 23-11-2015

Accepted on 25-02-2016

Published on 18-03-2016

<http://dx.doi.org/10.6000/1927-5129.2016.12.23>

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