

The spatial dimension of farm crops production in the Arab countries

Saif Al-Qaydi

**Unit of Government, Policies and Urban Planning, Geography Program, UAE University,
P. O. Box 17771, Al-Ain, UAE**

Abstract: The economical production of food should be a main goal of Arab countries that has to be approached at a macro level by examining cross-border efficiencies. More efficient tomato, wheat and potato cultivation are vital to fostering self-sufficiency. The purpose of this study is to determine geographical areas within the Arab world that would best serve agricultural needs by providing the setting for the production of specific farm crops. An analysis was conducted of key consumer centers and regions of agricultural production. The available resources in different geographic locales were examined in view of determining the most efficient distribution of agricultural production. It was found that farm crops such as wheat can be produced far more economically in the Nile Valley and the Sham farming regions than in other Arab farming regions. More technological and capital intensive production can be profitably carried out within the GCC countries. The study also discusses the important role of farm technology in improving the production of Arab farms.

Key words: Arab countries, agriculture, crops cost, spatial dimension, technology, geography.

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Introduction

Despite international efforts by the United Nation (UN) to encourage

countries to grow more food to feed their nations, many are still not getting their food needs met. Many nations are striving to improve the quality and availability of

food. In 2000, the agricultural sector took only 7.4% of the \$15.3 billion borrowed from the World Bank (World Bank, 2001). This share put agriculture at fifth on a list of 17 sectors ranked in terms of the amount of money borrowed from the World Bank.

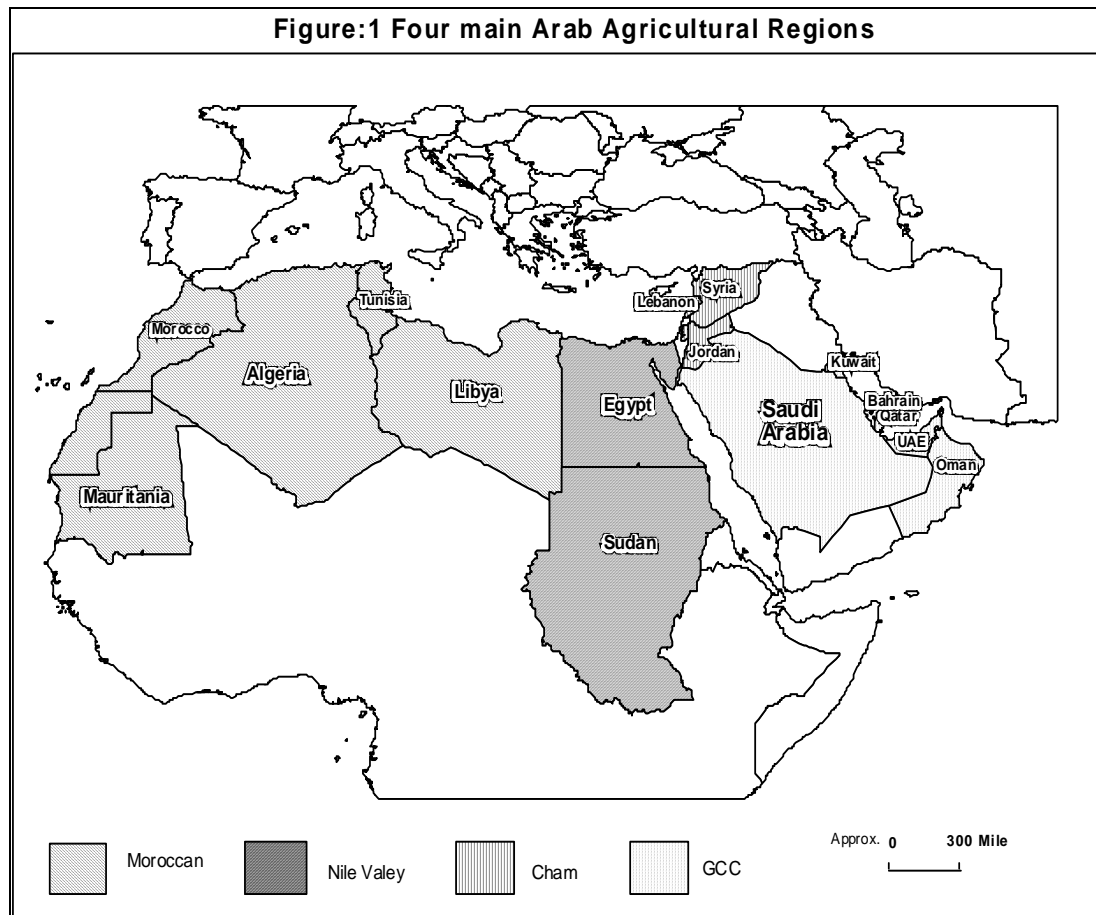
In modern societies, the costs of production are often the deciding factor in determining whether a country produces its own food or imports it. Of course, for the sake of food security, it is preferable that each country produces enough to meet its own needs. From an economic perspective, however, each country or region has to consider the cost difference between producing and importing the same crops. Recent world events, starting with the New World Order, have created an urgent need within the Arab World for more food production.

The end of the Cold War meant a cut back in the supply of imported food for some Arab countries which had previously obtained supplies from the former Soviet Union and other eastern European countries. Faced with reduced supplies, food production again became a focus of national concern. In the late 1970s, Wortman and Cummings (1978) specified three main dimensions for food production and how to build a food strategy; a) food, b) poverty, and c) population. In this study, we add a fourth dimension to the analysis of farm crops production in the Arab World – space.

Recent developments, e.g. the unified European market implemented by the European Community (EC), as well as the Gulf Co-operation Council's (GCC) unifying Trade Tariff that was implemented in 2005, raise important issues about the integration of the economic activities between diverse parties in the Arab World. Most studies conducted in this field (Abdusalam, 1998, AOAD, 1999, Hussain, & Al-Saati, 1999,

Al-Obaid, 2004), focus on food issues, such as food security, the food gap between Arab nations, alternatives to ground water irrigation of farm crops as a new technique, Arab foreign agricultural trade and the possibility of establishing Arabian Free Trade Zones. This study involves the selection of the best regions for the most economical production of certain crops with the appropriate physical and human environments. Hoping to contribute to this effort, this paper attempts to evaluate the spatial dimension of Arab countries as a means of studying their crops production and food security. The paper also examines the possibility of having Arab countries specialize in the production of specific crops that are most suited to their agricultural environment. Based on the data that is readily available, three geographical regions are suggested as most appropriate for growing wheat, potatoes, and tomatoes in the Arab World.

We explore the possibility of investing available capital from the relatively wealthy GCC countries (Saudi Arabia, Oman, UAE, Kuwait, Qatar, and Bahrain), to support farming activities in countries more suited to agricultural production. The idea is to encourage the transfer of food between Arab countries most suited for their production to those least able to develop their own agriculture (Figure 1). In addition to the GCC countries, we identified three other major country-groups within the Arab world which are pooled according to the similarities in their geographical and farming environments: the Nile Valley (Egypt and Sudan), Sham (Lebanon, Jordan, and Syria), and Maghrib (or Moroccan) (Morocco, Tunisia, and Algeria). For the research purposes, other Arab countries (Iraq, Yemen, Somalia, Djibouti and Comoros) are not included in this study, but all of them can create their own separate farming environment.



Major geographical characteristics Of the Arab countries

The Arab countries cover an area of 13.9 million square kilometers. They stretch some 8,000 Km from the Atlantic Coast to the Arabian Sea. This area is spread over two continents, with 72% located on the African land mass, and the remaining 28% in Asia (League of the Arab States, 2006). Most Arab land is located in desert and semi-desert regions, and the landscape is dominated by dry climate conditions. The Atlas mountain ranges of northern Africa form a barrier between the Sahara Desert and the coastal area, facilitating seasonal rainfall in Morocco, Tunisia, and Algeria. Other mountain ranges are found in parts of Lebanon and in Zagrus to the east of Iraq, and these serve also to facilitate some winter precipitation. The Al-Hajar Mountain Range in the east (Oman and

the UAE) experiences some winter precipitation and some orographic rain during summer associated with high humidity, while the Dhufar Mountain, south of Oman are affected by the summer monsoon. Since the Nile and Tigris-Euphrates are the only major rivers flowing through the Arab World, this situation leaves great concerns over water limitations preventing the development of greater farm production in the area.

Of the 310 million people living in Arab countries in the year 2006, 55% reside in urban areas, pushing up the demand for farm crops. These needs are met somewhat by the remaining 45% of the population who live largely in rural areas and who rely on agriculture as their main economic activity. Wheat, barley, rice, maize, and millet are the most consumed crops within the region, while sesame, cotton, sugar beets, and sugar

cane are exported as cash crops (www.amf.org.ae).

Looking more specifically at the individual countries, we find that 35 % of the total Arab population lives in the Nile Valley, 9.2% in the Sham region, 29% in the Moroccan countries, and 11.3% in the GCC countries (Table 1). In four Arab countries, a significant percentage of the population lives in poverty. According to

Tawfiq & Kurdi (2000, p.229), between 1989 and 1994, 57% of the Mauritanian population was living below the poverty line, along with 15% of Jordanians, 14% of the Tunisians and 13% of the Moroccans. These figures changed in 2003 to reach approximately 46% in Mauritania, 11.7% in Jordan, 7.6% in Tunisia and 19% in Morocco (<http://siteresources.worldbank.org>).

Table 1. Population and area of the Arab countries in 2006.

Countries	Area (Sq. Km)	Population (000)	Pop/sq. km	Rural pop. %	Urban pop. %
Algeria	2381741	32795	14	41	59
Bahrain	707	727	1028	12	88
Djibouti	23200	792	34	40	60
Egypt	1002000	70019	70	55	45
Emirates	83600	4105	49	22	78
Iraq	435052	27960	64	29	71
Jordan	89342	5473	61	27	73
Kuwait	17818	2991	157	3	97
Lebanon	10452	3892	372	11	89
Libya	1775500	6629	4	13	87
Mauritania	1030700	2981	3	45	55
Morocco	710840	31072	44	46	54
Oman	309500	2325	8	19	81
Palestine	--	--	--	65	35
Qatar	11427	796	61	33	67
KSA	2000000	23079	12	15	85
Somalia	637657	10082	16	85	15
Sudan	2505805	34262	14	66	34
Syria	185180	18138	98	49	51
Tunisia	155566	10030	64	36	64
Yemen	555000	21531	39	74	26
TOTAL	13921087	309679	22	39	61

Source: www.amf.org.ae, 2007

In the GCC, the majority of the population lives in urban areas: 88% in Bahrain, 78% in UAE, 97% in Kuwait,

81% in Oman, 67% in Qatar, and 85% in Saudi Arabia (AOAD, 2007). Their main economic activity occurs in the service

sector. As shown in Table 2, this area dominates in Kuwait (92%), Qatar (86%), Saudi Arabia (85%), Jordan (83%), UAE (81%), Bahrain (74%) and Oman (71%). In contrast, people in the rest of the Arab With the available natural resources, water and fertile soil, the farm crop production in the Nile Valley is considered below the expectation. For example, most of the Egypt rice production is consumed in local markets, leaving only a small quantity for exporting (Table 3). In general, the countries of the Nile Valley get the benefit of the availability of relatively cheap farm labor, reliable water sources, and fertile soil. These factors suggest the viability of increasing farm production in

the Nile Valley, which also has the benefit of being located in the Moroccan countries, Sham and the GCC countries. A third key advantage is the easy access it enjoys to maritime transportation routes through the Nile, the Mediterranean and the Red Sea.

World rely more heavily on farming activities as their main source of economic activity. Djibouti leads the pack (77%), followed by Sudan, Mauritania and Yemen with percentages of 57%, 52% and 46% respectively. The study shows that the Nile Valley countries have the highest rural population concentration. Sixty six percent of the total Sudanese population lives in rural areas, along with 55% of Egyptians.

Table 2. Percentage of labor force in the Arab countries, 2000 and 2006.

Countries	Farming		Industry		Services	
	2000	2006	2000	2006	2000	2006
Algeria	24.8	23.3	21.1	18.4	54.1	58.3
Bahrain	1.1	0.9	30.2	25.1	68.7	74.0
Djibouti	80.4	77.0	2.9	6.4	16.7	16.6
Egypt	29.5	30.4	21.8	21.5	48.7	47.7
Emirates	8.0	4.0	14.7	15.2	77.3	80.8
Iraq	11.1	8.3	22.8	20.3	66.1	71.4
Jordan	12.0	10.1	8.5	7.4	79.5	82.5
Kuwait	1.9	1.7	18.8	6.3	79.3	92.0
Lebanon	4.3	2.9	35.3	29.9	60.4	67.2
Libya	6.7	4.6	19.8	19.4	73.5	76.0
Mauritania	53.4	51.9	5.0	4.9	41.6	43.2
Morocco	37.7	33.1	21.3	19.7	41.0	47.2
Oman	36.6	8.3	11.8	20.3	50.6	71.4
Palestine	--		--		--	
Qatar	1.6	1.2	7.6	11.3	90.8	87.5
Saudi Arabia	11.4	7.4	10.4	7.9	78.2	84.7
Somalia	72.5		N/a		N/a	
Sudan	62.9	57.4	9.9	8.1	27.2	34.5
Syria	24.6	26.2	28.9	24.4	46.5	49.4
Tunisia	25.2		29.0	27.5	45.8	49.4
Yemen	52.6	46.4	10.0	8.2	37.4	45.4

Source: League of Arab States, Secretarial General, Annual economic Report, 2002.
www.amf.org.ae, 2007

Table 3. Egypt Rice Production, Consumption, and Stock Local Market Years (Thousands Metric Tons).

Classification	2002/03	2003/04	2004/05	2005/06	2005/06	2006/07	2006/07
Milled				9-Jun	12-Jul	9-Jun	12-Jul
Production	3,705	3,900	4,128	4,130	4,130	4,140	4,140
Consumption	3,200	3,225	3,250	3,275	3,275	3,300	3,300
Ending Stocks	870	719	502	357	357	397	397

Source: USDA, 2007

The existing agricultural situation in the Arab countries

Many Arab countries witnessed an increase in food production at the end of the 1970s, to the early 1980s. Ten years later, in the early 90s, a few Arab countries (Saudi Arabia, Syria, Libya, Tunisia, and Morocco) showed a tremendous increase in their food production (Abdusalam, 1998), while others (e.g. Sudan, Somalia, and Yemen) suffered badly from the effects of poor farming practices and a shortage in farm technology. The countries that did well represented 48% of the total population of the Arab world, and they managed to increase their per capita agricultural production significantly by implementing effective agricultural strategies.

In 2004, the four Arab countries with the highest agricultural output per capita were: United Arab Emirates (\$700), Saudi Arabia (\$437), Tunisia (\$372), and Syria (\$304). (Table 4). Most of high figures are results of using the new technology in farming activities e.g. in United Arab Emirates and Saudi Arabia, especially in growing crops under controlled environments, like in greenhouses. However, the four countries with the lowest per capita agricultural product in the same period were Djibouti (\$30), Jordan (\$52), Qatar (\$74) and Somalia (\$73). Most of these countries either suffer from a shortage in fertile soil and water, e.g. Qatar, or some other local situation, e.g. in Somalia civil war. In

general, most of the Arab countries import a large portion of their farm crops, especially cereal, from the international market.

Arab agricultural labor force

The two factors expected to play a major role in future Arab farm crop production are the large agricultural labor force concentrated in the Nile and Maghrib regions and the newer farming technologies. The geographical concentration of Arab farmers in two regions could be best utilized by increasing the farm land area in these regions which could create new job for those people. Figure 2 illustrates the eleven largest Arab farm labor forces. About 34 million which represent 32% of the entire Arab population are involved in agriculture (Figure 2). In 2004, the agricultural labor force in the Nile Valley (Sudan & Egypt) alone represented more than 48% of the total agricultural labor force in the Arab World. This percentage illustrates the need for more focus in the farming sector. New projects could utilize the large farming labor force concentration in these countries.

In contrast, three of the six GCC countries (Qatar, Kuwait and Bahrain) represented lower numbers of farm labor due to their larger focus on the service sector which can be understood simply by their limited availability of fertile soil and water (Table 5).

The breakdown of the availability of farming labor indicate that with some education and training programs, the Nile Valley has the potential to be the specialist in the production of cereals, e.g. wheat and rice, in the Arab World.

The cost of producing agricultural crops in the Arab countries

The cost of producing food on Arab farms varies from country to country and from farm to farm within the same country. In general, costs of production depend on the farming inputs used per-crop-unit. Major influencing factors include the size of the farm, the type of soil, labor costs, government policies, types of crops, weather characteristics, and so on. Of course, all of these factors affect food production in the Arab

countries to a greater or lesser extent. However, a complaint common among farmers across the region is that the cost of producing and marketing for their crops is unsustainably high in comparison to those of European and American farmers. The foreign farmers, they point out, receive substantial government subsidies that allow them to sell at a more competitive price.

To understand this concern, we selected a number of Arab-grown crops and compared their production costs across the four main agricultural regions listed above: the GCC, Sham, Nile Valley, and the Moroccan countries. The following figures illustrate some of the farm crops which could be grown more economically in certain farming regions in the Arab countries.

Table 4. Per capita of gross domestic product and agriculture product (current price) 2002-2004 (US Dollar).

Country	Per capita agri. product			Per capita gdp		
	2004	2003	2002	2004	2003	2002
Jordan	51.59	47.2	39.41	2152.34	1902.8	1794.15
Emirates	700.52	673.45	710.72	26450.04	23955.84	21701.26
Bahrain	93.35	88.48	84.81	15653.47	13933.45	12569.13
Tunisia	371.51	327.62	243.36	2951.61	2720.39	2366.41
Algeria	240.9	208.51	168.65	2624.41	2152.25	1834.04
Djibouti	29.87	28.86	66.07	988.53	949.23	914.47
Saudi arabia	437.39	431.63	430.35	11050.94	9527.47	8428.74
Sudan	241.48	212.91	187.49	638.01	568.27	502.76
Syria	304.39	302.84	303.39	1320.8	1220.38	1206.6
Somalia	73.12	85.95	87.93	114.19	114.84	117.21
Iraq	117.58	76.63	108.62	1241.71	760.18	1054.74
Oman	179.85	200.93	220.37	10604.85	10306.87	10860.19
Palestine	92.82	128.62	100.87	955.35	1049.07	1090.82
Qatar	73.92	75.97	72.89	38239.1	32736.19	28727.41
Kuwait	91.13	87.35	83.36	21335.81	18594.55	16125.97
Lebanon	338.1	314.44	305.63	4331.25	4027.33	3913.51
Libya	201.6	187.83	193.64	4701.09	4291.9	3529.99
Egypt	159.06	185.26	198.06	1121.41	1187.14	1285.62
Morocco	302.32	270.42	196.42	1673.73	1472.14	1218.12
Mauritania	82.89	79.87	68.97	476.79	424.5	368.33
Yemen	90.37	82.36	77.28	654.56	574.5	527.79
G. Average	220.99	211.52	199.73	2833	2493.45	2292.84

Source: <http://www.aoad.org/AASY25/AASY25/Chap1/Tab8.htm>

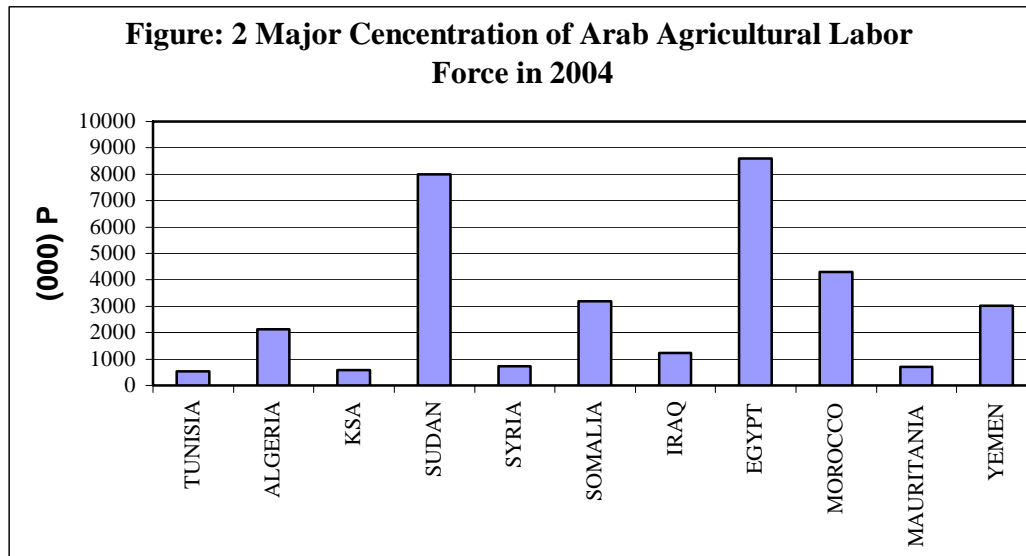


Table 5. Agricultural labor force and total labor force in the Arab world in 2004 (1000 person).

Country	Agricultural labor	Total labor
Jordan	72.5	1172
Emirates	67.06	1668.72
Bahrain	9.12	340
Tunisia	543	3328.6
Algeria	2125.51	7798
Djibouti	272.01	354.07
Saudi Arabia	582.2	7504.9
Sudan	7989	13774
Syria	734	4908
Somalia	3200	4570
Iraq	1229	6516
Oman	362.01	1083.07
Palestine	92	790
Qatar	4	341.08
Kuwait	14	1395.55
Lebanon	41.02	1413.14
Libya	93.16	2018.59
Egypt	8595.42	27898.45
Morocco	4296.03	12979.47
Mauritania	689.39	1328.03
Yemen	3017.79	6505.92
Total	34028.22	107687.59

Source: <http://www.aoad.org/AASY25/AASY25/Chap1/Tab2.htm>

The cost of producing wheat

Wheat is one of the most important cereal crops in the world, and it makes up an important part of the diet of many people in the Arab World. In 2002, the Arab countries produced 21.5 million metric tons of wheat, 29% produced from

the Nile Valley and only 8% from the GCC countries. This level of production covered only 51.5% of the total consumption of countries, leaving more than 48.5% of their demand to be met by way of imports from world markets (League of Arab States, 2002).

Table 6 illustrates how wheat, as a strategic crop, can be produced in most of the Arab regions including Moroccan, Nile Valley, Sham, and the GCC countries. The cost of wheat production is understandably higher in the GCC than that in the Nile Valley. Of all Arab countries, from a purely geographical perspective, countries in the Nile Valley represent the most ideal region for wheat production. One example of the region's advantage is in the cost of irrigation,

which costs is less than \$25/hectare in Sudan (Nile Valley), compared to \$123 in Oman (GCC). In terms of human power, the cost of labor in Sudan is less than \$9.5/hectare, In Oman, while it reaches more than \$616/hectare and \$70.5/hectare in Oman and Jordan, respectively (AOAD, 2003). Because of such key differences, we argue that the Nile Valley could potentially be the breadbasket for the Arab world.

Table 6. Cost of wheat production in selected Arab countries in 2002 (in US dollar/ hectare).

Item	Oman (GCC)	Jordan (Sham)	Sudan (N.Valley)	Tunisia (Moroccan)
Material Inputs				
Seed/seedlings	92.46	48.64	59.52	59.49
Fertilizers	84.20	31.73	53.34	100.87
Pesticides	N/A	21.15	2.38	48.60
Farm Power				
Machinery	184.92	67.68	54.28	245.21
Human	616.42	70.50	9.52	49.99
Irrigation water	123.84	28.20	25	N/A
Land rent	369.85	352.50	N/A	135.60
Others	61.64	N/A	28.56	N/A

Source: Arab Organization for Agricultural Development.
Arab Agricultural Statistics Yearbook. 2003.

The cost of producing potatoes

In 2002, Arab countries imported a total of about 666,000 metric tons of potatoes at cost of \$248 million. This is an amount that could have easily been grown domestically. As a result of the improving conditions for growing potatoes, the yield of potatoes increased from 15,000 kilogram/hectare in 1992 to more than 22,000 kilogram/hectare in 2004 (<http://www.aoad.org>). Again, the Nile Valley region presents an ideal location for the production of potatoes, mainly because of its abundant labor

supply and lower labor costs. The per hectare output cost is less than \$166/hectare in Sudan, compared to \$813 in Oman (GCC), \$666 in Morocco (Moroccan), and \$656 in Syria (Sham) (Table 7).

The availability of capital in the GCC countries could be utilized to grow food in this region, and cheap sea and land transportation used to move production to the GCC countries where the modern road networks allow for relatively easy marketing.

Table 7. Cost of potatoes production in selected Arab countries in 2002 (in US dollar/hectare).

Item	Oman (GCC)	Syria (Cham)	Sudan (N.Valley)	Morocco (Moroccan)
Material inputs				
Seed/seedlings	1436.88	1655.66	407.39	1388.75
Fertilizers	174.34	223.92	78.72	611.05
Pesticides	49.18	105.74	18.00	499.95
Farm Power				
Machinery	129.44	252.97	9.42	112.10
Human	813.67	656.53	166.6	666.60
Irrigation water	257.19	238.70	71.00	355.52
Land rent	369.85	104.57	N/A	335.30
Others	61.64	379.83	160.75	144.43

Source: Arab Organization for Agricultural Development.
Arab Agricultural Statistics Year book., 2003

The role of international technology transfer in Arab agriculture

The free market policy between GCC countries has had a noticeable impact on farming. The implementation of open market policies in the GCC allows farmers to purchase farm needs competitively from all over the world. Another advantage that agriculture has gained from the implementation of a free market policy in some Arab countries is the improvement of farming techniques, tools, and equipment. As illustrated in Table 8, because of the availability of capital and technology, the production of tomatoes can be far more economical grown in a controlled environment in the GCC countries rather than anywhere else in the Arab World. Seeds can be imported from countries such as Holland and the United States at a low cost of about \$6.60/hectare, compared to \$271/hectare in Syria and \$120/hectare in Egypt. Pesticides also cost less in the GCC countries than in some other Arab

countries. Bahrain took advantage of this policy and implemented a capital intensive drive to grow tomatoes in greenhouses which allow for increased quality outputs in controlled environments.

The use of greenhouse farming techniques is not new. It has been used for several years in countries including Japan, the United States of America and Europe. In recent years, the expanse of land assigned to greenhouse farming practices in the Arab World has increased from 146 thousand hectares in 2002 to more than 178 thousand in 2004. Such production has increased in tandem with the increased land area from 4.4 million metric tons in 2002 to more than 5,1 million metric tons in 2004 Table 9. Indeed, such techniques are viable alternatives to the traditional methods of food production in agricultural-land scarce countries, leaving more hospitable environments for the growth of cereals vital to feed the Arab World.

Table 8. Cost of tomatoes production in selected Arab countries in 2002 (In US Dollar/hectare).

Item	Bahrain	Syria	Egypt	Morocco
Material Inputs				
Seed/seedlings	6.63	271.25	120.69	44.44
Fertilizers	1224.30	290.62	299.88	499.95
Pesticides	32.59	185.83	79.80	611.05
Farm Power				
Machinery	7.95	310.28	196.38	111.10
Human	1113.00	958.02	510.52	1333.20
Irrigation water	763.20	286.44	N/A	499.90
Land rent	145.75	537.07	408.22	222.25
Others	100.70	768.48	118.59	233.31

Source: Arab Organization for Agricultural Development.
Arab Agricultural Statistics Yearbook, 2003

Table 9. Greenhouse production in the Arab world (production in 1000 mt, area in 1000 ha).

Country	2004		2003		2002		Average Period 2001-1997	
	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area
Jordan	214.80	5.19	277.60	6.35	278.10	5.48	191.65	4.31
Emirates	N.A	0.31	N.A	0.31	N.A	0.31	N.A	0.29
Bahrain	2.58	0.04	2.46	0.04	2.58	0.04	2.58	0.04
Algeria	358.92	6.49	311.60	6.00	270.01	5.04	224.82	3.77
Saudi a.	479.72	5.51	419.13	4.85	N.A	N.A	148.00	N.A
Syria	438.95	3.79	427.27	3.68	393.31	3.01	396.79	2.90
Iraq	1049.00	96.00	890.42	65.56	1535.00	83.50	1127.50	73.42
Oman	N.A	N.A	17.00	0.04	N.A	N.A	N.A	N.A
Palestine	372.05	4.07	292.52	3.91	N.A	N.A	N.A	N.A
Qatar	5.50	0.06	5.50	0.60	5.50	0.06	N.A	0.06
Kuwait	81.26	1.25	103.72	1.51	81.26	1.25	68.16	1.21
Lebanon	326.34	4.37	326.34	4.37	326.34	4.37	N.A	50.00
Egypt	799.81	37.19	799.81	37.19	725.98	32.96	494.82	11.74
Moroco	994.59	13.85	699.25	9.95	785.00	10.28	694.35	9.32
Yemen	30.66	0.24	7.40	0.32	N.A	N.A	N.A	N.A
Total	5154.18	178.36	4580.02	144.68	4403.08	146.30	3348.67	157.06

Source: <http://www.aoad.org/AASY25/AASY25>

A technological formula to improving Arab farm crop productivity

There are many alternative ways to improve farm crop production in the Arab World, one of which is the use of technology. Despite the worldwide focus on biotechnology, some Arab countries lag far behind in this area. With determination and good farming strategies, these new farming technologies can be applied to grow crops more profitably (Anderson, 1989).

New farming techniques: With the worldwide availability of technology and new knowledge about farming, one could easily argue that the Arab countries will need to improve their farming techniques to enable them to produce more food less expensively. These farming technologies could be utilized in irrigation methods, soil and improved seeds.

New crop varieties: The use of improved seeds including disease-resistant strains and other genetically engineered crops needs to be widely adopted. These require the intensive use of new technologies that can be imported from neighboring countries.

Machinery: Farming activities require the heavy use of tools and equipment, such as tractors, cultivators, and post-harvest equipment, including small farming tools. This equipment has to be made affordably available to individual farmers and government holdings.

Manufactured inputs: Among other farming inputs, pesticides, fertilizers, and other agricultural chemicals are needed during farming activities, as these allow for increased crop productivity. As with some forms of machinery, not all Arab farmers are able to purchase these items. With the help of the world community, they may be able to do so in future.

Management techniques:

Contemporary farming techniques demand more use of electronic devices, like computers and climate controls. All these require a professional labor force to deal with these devices. Also, growing and selling the product at the right time at high prices needs some management techniques.

Farming research centers: Having the resources and the available labor force, some Arab countries may be encouraged to establish research centers to study farming techniques and practices within the unique environments of the Arab world. The agri-tissues field, pesticides, and chemical fertilizers could be some of the main focuses of these research centers, and these can have strategic value in light of the flourishing petrochemical industry in the GCC countries. A new generation of young Arab agricultural scientists could be directed to investigate high-demand crops and to help farmers to bridge the yield gap between local and foreign producers.

Conclusion

Based on the above discussions, there is an urgent need for a comparative study to be carried out, in order to match the type of crops grown in the most suitable environments within the Arab World.

Because of the need to control weeds and diseases, and to maximize the use of farm equipment, it is often advantageous for individual farmers to produce more than one commodity. This allows them to manage the risks associated with potentially lower market prices and production failures. A focus on more than one crop is common in farming communities around the world, including European and American farms (Ahearn, 1990) and should be encouraged among Arab farmers.

It is also recommended that some Arab organizations, such as the League of

the Arab States, the Secretarial General of the Gulf Cooperation Council and the Arab Organization for Agricultural Development play more major roles in evaluating the arable land that is available. Due to their location and the availability of natural resources, some Arab countries (Nile Valley and Sham) are more to produce certain crops. With an effective farm strategy and concerted effort by leaders of the Arab nations in collaboration with international players, important steps can be taken to enable Arab countries to produce the most appropriate crops and meet their long-term strategic needs.

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