

Pesticides, Fertilizers and Food Safety

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I. INTRODUCTION

Arab countries face profound sustainability challenges that will influence their ability to achieve lasting environmental goals. The rapidly changing and globalizing food economy and the concerns and commitments of a wide range of stakeholders about food production and security, food safety and quality, and the environmental sustainability of agriculture have prompted international organizations to establish standards for the safe production of fresh crops that can be safely consumed. Fertilizers and pesticides, when used in higher quantities than needed, become contaminants to food, feed and environment. However, when used properly, they will improve crop yield and quality. In the Arab countries as in every other region of the world, the misuse of pesticides and fertilizers is common; it is thus a subject that should be given sufficient magnitude and attention.

II. FERTILIZERS AND PESTICIDES USE IN THE ARAB COUNTRIES

The Arab world is faced with many constraints, such as: limited arable land (per capita about 0.22 ha); severe water shortages (16 countries are below the deficiency level of 500 m³ per capita of annual renewable water resources); poor soil fertility; low investments in water-saving irrigation



techniques; inappropriate pricing for agricultural commodities; and weak marketing systems. Over 55% of the increase in agricultural production was generally attributed to the use of fertilizers. The existing food gap in all Arab countries

FIGURE 1

FERTILIZER CONSUMPTION IN THE MIDDLE EAST REGION

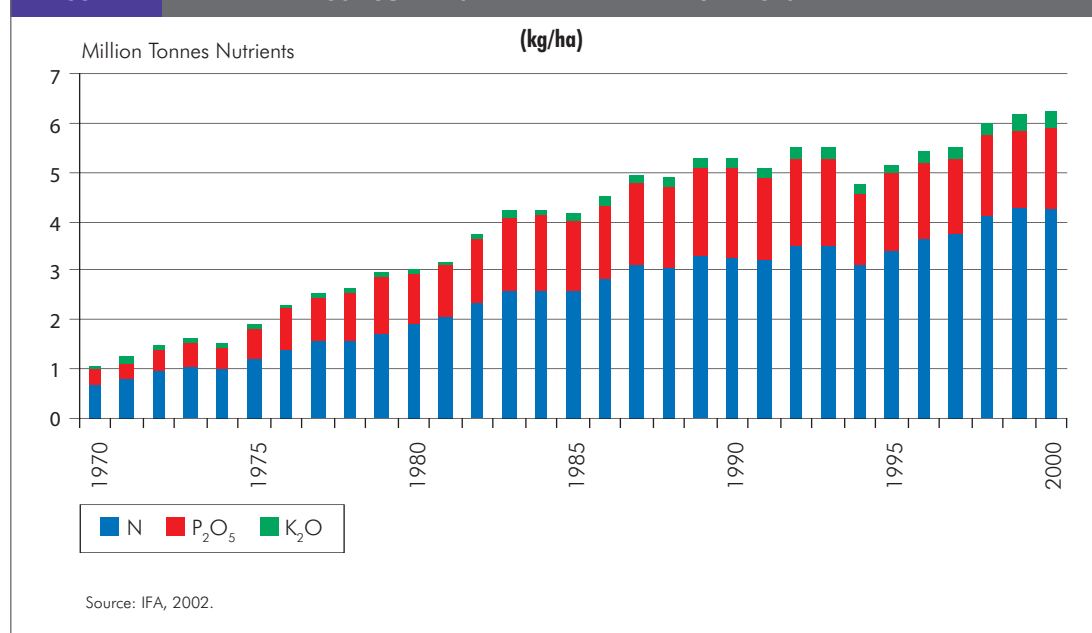


TABLE 1 TOTAL ANNUAL FERTILIZERS CONSUMPTION (Kg/ha) IN ARAB COUNTRIES

Country	Population (x1000) as of 2004	Arable Land (1000 ha) as of 2000	Total use of fertilizers (ton) in 2002	Average Rate of fertilizer (kg/ha)
Algeria	32,339	7,662	196,000	26
Bahrain	739	2	200	100
Egypt	73,390	2,801	2,537,606	906
Iraq	17,357***	5,300*	414,000*	78
Jordan	5,614	242	67,000	276
Kuwait	2,595	10	2,100	210
Lebanon	3,708	190	78,840	414
Libya	5,659	1,815	123,800	68
Mauritania	2,980	488	5,800	12
Morocco	31,064	8,767	798,000	92
Oman	2,935	38	24,466	644
Qatar	619	18	1,800**	100
Saudi Arabia	24,919	3,592	762,600	294
Sudan	34,333	16,233	138,992	8
Syria	18,223	4,542	645,610	142
Tunisia	9,937	2,864	204,000	72
UAE	3,051	60	70,000	1,166
Yemen	20,733	1,545	23,200	16
TOTAL	290,195	56,169	6,094,014	4,624

Source: FAO, 2006.

* 1990 - ** 2001 - *** 1989 - 1991

(except perhaps Syria) would necessitate a vertical expansion in agricultural production to meet the increased food demand (Hamdallah, 2007)

Fertilizers

The consumption of NPK ($N + P_2O_5 + K_2O$) fertilizers in the Middle East region increased from 1.5 million tons in 1970 to more than 6 million tons in 2002 (Figure 1). The major share of elements goes to nitrogen; phosphatic fertilizers are used at a smaller rate and then potassium is used in very low quantities (Figure 1).

Relative to the cultivated area, the rate of applied fertilizers in the region (overall average 108 kg/ha) is lower than the world average of 218 kg/ha in 2002 (Table 1). The data of the FAO (Food and Agriculture Organization) and ESCWA (United Nations Economic and Social Commission for Western Asia) shows that the UAE and Egypt use the highest rates (more than 900 kg fertilizers per hectare) followed by Oman (644 kg/ha) and Lebanon (414 kg/ha). However, other countries like Sudan, Yemen and Mauritania use very low rates of fertilizers (8–20 kg/ha). Another problem in the use of fertilizers

in the Arab states is the imbalanced application of nutrients (Hamdallah, 2007).

Following are some examples of impact of fertilizers on food (Havlin et al., 2005):

- Adequate supply of N increases protein quality and quantity (more of the essential amino acids) and some vitamins.
- Excessive N supply tends to increase amide content, resulting in bad flavour after cooking, or in raising the nitrate content to unacceptable levels, especially in vegetables grown under protected culture systems.
- Low N causes premature ripening, while high N causes delayed ripening.
- High amounts of N and K decrease dry matter and starch content and affect the quality of starch in potatoes; low K affects the coloration of fried potatoes negatively and causes black spots in fresh potatoes.
- Adequate Ca supply leads to high quality of different fruits and vegetables. Ca deficiency causes low quality banana fruits (fruit peels and splits at ripening).
- Sulphur increases the protein content in grain and the oil content of oil-seed crops.

Pesticides

There is a shortage of and a gap in the provision of data on the use of pesticides (herbicides, insecticides and fungicides) given that fewer than half the ESCWA member countries provided data for 2000, and only two countries provided such data for 2001 (Table 2).

The data in Figure 2 shows that the rates of pesticides usage per hectare in Lebanon, Kuwait and Qatar are 2 to 3 times the rates used in Egypt, Jordan and Oman. Farmers should use these chemicals only when needed and in moderation to avoid sending to the market low quality products, especially fruits and vegetables which are consumed fresh.

III. FOOD SAFETY IN RELATION TO FERTILIZERS AND PESTICIDES USE

Food Safety is increasingly viewed as an essential public health issue in the Arab region. In collaboration with the WHO, most countries of this region have undertaken extensive reviews of their food safety systems and have updated their national legislation. In many countries in the Middle East, legislation is inflexible and unable to cope with new challenges. Often standards are not consistent with international and national needs.

In this context the FAO has established Good Agricultural Practices (GAPs) and defined this concept as: “Applying available knowledge to

addressing environmental, economic and social sustainability for on-farm production and post-production processes that result in safe and healthy food and non-food agricultural products.”

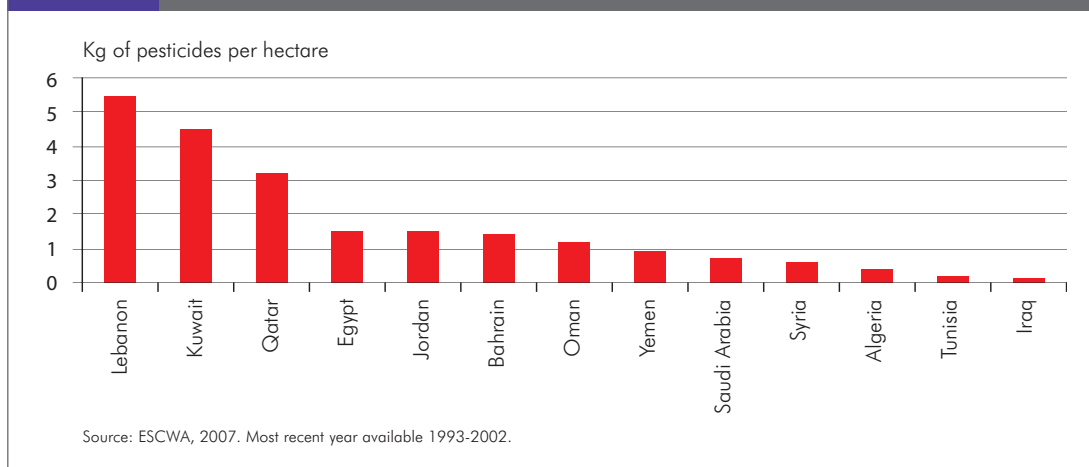
From the time of planting a crop until its consumption, there are many opportunities for contamination with harmful microorganisms, pesticides and other toxic substances. On the farm, soil, manure, water, animals, equipment, and workers may spread such contaminants. Produce may be harvested on a farm, processed in one plant, repackaged in another, then stored, displayed, or served commercially or in the home. Each of these steps is an opportunity for harmful contamination of the food supply.

The Codex Alimentarius Commission was established in 1963 by the FAO and the WHO (World Health Organization) to develop international food standards, guidelines and recommendations to protect the health of consumers and to ensure fair practices in food trade. This collection of food standards, entitled the *Codex Alimentarius*, or the food code, has become the global reference point for consumers, food producers and processors, national food authorities and participants in the international food trade (FAO/WHO, 2004).

Almost all countries of the Near East region are members of the Codex Alimentarius Commission. Their participation in Codex work, however, is very erratic and certainly not as effective as it could be in protecting their interests.

FIGURE 2

AMOUNT OF PESTICIDES USED IN KG/HA IN SELECTED ARAB COUNTRIES



The Codex Alimentarius Food Hygiene Committee mandated a working group in 1991 that has since developed guidelines for the Hazard Analysis and Critical Control Point (HACCP) application which is a process control system designed to identify and prevent microbial and other hazards in food production.

Although the Best Management Practices (BMP) and quality assurance systems such as HACCP have been introduced throughout the region, they are not fully integrated in the domestic inspection systems which continue to focus primarily on end-product control. In a number of countries, many industries apply HACCP on a voluntary basis in order to improve food safety domestically as well as increase their share of export markets.

Crop protection is probably the most limiting factor in crop production. The wide range of pests that attack crops during the various stages of growth from seed to fruit necessitate the application of various means of pest control. Farmers have depended mainly on the use of pesticides to combat the multitude of pests. The development of the synthetic organic pesticides in the mid-forties was a turning point in pest control. Prior to this development, the available quantities of botanical and inorganic pesticides were limited and fairly expensive. In contrast, synthetic organic pesticides were produced in huge quantities and thus were readily available and at reasonable cost. In the beginning, the health hazards of pesticides were not sufficiently studied before their extensive use.

TABLE 2
TOTAL INSECTICIDES CONSUMPTION IN TONS PER YEAR

Country	2000	2001
Bahrain	7	6
Iraq	190	...
Jordan	61	...
Oman	91	...
Qatar	60	...
Syria	1,219	994
Yemen	933	...

Source: ESCWA, Compendium of Environment Statistics in the ESCWA Region, 2007.

Furthermore, crop pests and especially insects started to show resistance to these chemicals which in turn prompted farmers to use more and more quantities in their quest for efficient pest control. A second turning point occurred in 1962 with the publication of *Silent Spring* by Rachel Carson. The book alerted the scientific community and the public about the health hazards of pesticides and their indiscriminate use. The book was adopted by various environmental groups and induced a public awareness campaign about the hazards of pesticides. Consequently, the scientific community had to assess the situation and initiated various studies about the hazards of the commonly used pesticides and realized their risks to human and animal health as well as the environment. This resulted in the banning of several pesticides in many countries starting with DDT in 1973 (Kawar, 2007). All persistent chlorinated hydrocarbon pesticides





were finally banned in 2004 by the Stockholm Convention (Stockholm Convention on Persistent Organic Pollutants, 2008).

Standards for pesticide residues were developed, a particularly important element of which concerned the Maximum Residue Limit (MRL) for pesticides permitted on specific foods. The MRL is determined from a number of factors including:

- How much of the food is eaten in the average diet;
- How toxic the pesticide is; and
- How easily the food absorbs and retains the pesticide.

The problem of pesticide use in the Arab countries is not only a problem of unregulated use, but it is also a problem pertaining to the handling and misuse of pesticides at all levels.

IV. ORGANIC FARMING

Production and use of inorganic manufactured fertilizers has continued for about 160 years beginning with the use of calcium phosphate in 1843. By 1901, England had begun to use small amounts of manufactured nitrogen (N) fertilizer. Over the last 100 years, use of inorganic fertiliz-

ers has played a great role in the world's ability to sustain adequate agricultural production. The Arab countries are major producers and exporters of synthetic fertilizers in the world.

Popularization of the concept of so-called "natural" or "organic" agriculture and the increased environmental awareness in the Arab world has led to misconceptions regarding the effects of inorganic fertilizers on the quality and safety of agricultural products and the environment. In many situations, this misinformation has resulted in general public misunderstanding regarding the benefits of manufactured fertilizer application to crops. These misunderstandings commonly include four points:

1. Inorganic fertilizers pollute agricultural produce and negatively affect human and animal health. For example, high nitrate in vegetables.
2. Application of inorganic fertilizer decreases agricultural produce quality.
3. Manufactured inorganic fertilizer application results in soil hardening and a decline in soil's fertility.
4. Manufactured inorganic fertilizer application can negatively affect the environment causing greenhouse gas emission, water pollution and the eutrophication of lakes, rivers, and seas.

According to some, the answer to all these so-called negative effects of manufactured fertilizers is to recommend an “organic farming only” or “green food” strategy which is supposed to produce agricultural products with little pollution and greater safety. It is a fact that this region needs to use the entire supply of organic nutrients (manure/crop residue) available, but it must also supplement it with balanced inorganic fertilizers to produce high yielding, high quality crops while protecting the environment (Potash and Phosphate Institute PPI, 2008).

Many scientific research results reported that manufactured fertilizers are harmless to human/animal health and in some situations may be more beneficial than organic sources. Negative effects from inorganic fertilizers are most commonly a result of improper use, a consequence that can just as easily occur if organic manures are misused. Thus, to ensure sustainable development of agricultural production and satisfy the requirement for safe agricultural products in the Near East, further discussion and understanding on this issue is needed.

V. CHALLENGES FACING THE ARAB COUNTRIES

Despite efforts to modernize food safety laws, there is limited information available to fully evaluate the food safety problems and issues in the Arab region. Pesticide regulations in the Arab countries have improved but are still not satisfactory. Regulations for the registration and import of pesticides have been established and a large number of pesticides have been banned. However, the sale and handling of pesticides is not regulated and there is no control over the use of pesticides. Accredited pesticide residue analysis laboratories are not available in many Arab countries, and frequently shipments of fresh produce are refused entry into an importing country because of residues exceeding the MRLs. It is imperative that all Arab countries establish such laboratories (De Waal and Robert, 2005).

The major constraints that face the Arab states for intra-regional trade include inadequate international transport and communication facilities and poor information about markets

and investment opportunities. Moreover, the existence of administrative and procedural obstacles to trade and the absence or inadequacy of a system for standardized packing, grading and quality control systems at the regional level continue to frustrate efforts to expand trade and establish transparent information systems. Improvement and harmonization of inspection and certification systems are among the missing ingredients for promotion of intra- and extra-regional trade. Inadequate financing and guaranteeing of regional exports/imports has also been a factor in some countries in the Middle East.

In most countries responsibility for the supervision and enforcement over food safety is shared among several agencies. In Lebanon, for example, food safety responsibility is shared among six different government agencies. Yet, it has no comprehensive food safety law, and the existing laws are not fully implemented. Extensive use of pesticides has led the European Union to ban some exports from several Arab countries (De Waal and Robert, 2005).

VI. CONCLUSIONS

New legislation and an institutional commitment to environmental governance are becoming extremely important. Creating regulatory systems to face the new challenges and to be updated regularly is the major task that Arab countries should start with. Although some countries perform better than others, all face issues that have to be tackled at the regional level and not merely the country level. Many countries have resources and capacities for a better performance if a commitment to greater environmental sustainability and food safety is made.

Governments should develop effective extension programs to teach farmers about proper methods for the use and handling of agrochemicals and adopt modern laws concerning the use of fertilizers and pesticides.

In addition, governments should consider institutional reforms and support the establishment of laboratories to ensure the safety of the food consumed, produced and exported from the region.

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