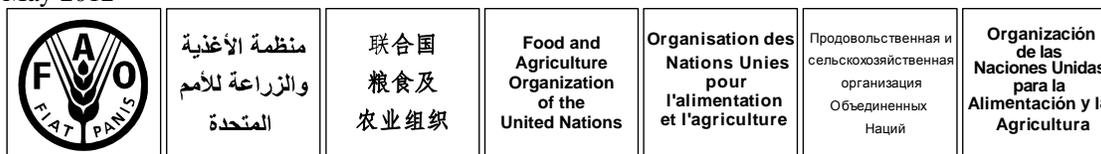


May 2012



# FAO Regional Conference for the Near East

<b>Thirty-first Session</b>
<b>Rome, 14-18 May 2012</b>
<b>FOOD LOSS PREVENTION FOR IMPROVING FOOD SECURITY IN THE NEAR EAST</b>

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### **Executive Summary**

1. The first solution that usually comes to mind to meet food demand is to increase food production, but another approach is to decrease food losses and waste, which will reduce the need for increasing the production area and the use of more natural resources (especially non renewable ones). Given the limited availability of natural resources, it is more effective to reduce food losses and waste than to increase food production.
2. Although only limited data on the magnitude of food losses and waste in the Near East (NE) region are available, it is generally estimated that more than 15% of cereals and legumes and more than 30% of perishable foods (i.e. fruits, vegetables, dairy products, meats and fish) are wasted annually. Food security, food production, food loss reduction, and food safety go hand in hand. Reducing food losses and waste in order to increase food availability and food security for the NE population is much less costly than increasing production by increased production inputs and/or increasing imports. Losses of foods reflect also loss of water, land and energy, and other resources used to produce them.
3. General strategies for reducing food losses and waste include: (1) application of current knowledge to improve the food handling systems and assure food quality and safety; (2) removing the socioeconomic constraints, (3) more education to all stakeholders of the chain, including farmers and consumers, (4) better and adequate infrastructure, including storage facilities and marketing systems, (5) improved research and development capacity; and (6) special attention to overcoming the limitations of small-scale producers.
4. How best to further develop and implement these strategies is a key element in any agro-industrial development plan. Specifics will vary by country and by type and market value of food product, so a first step will be to better characterize local food sector development needs on a case by case basis.

### **I. General Background on the Near East Region**

5. The vast majority of NE countries suffers from severe water shortage and deterioration of water and land quality due to many reasons including increase in population growth rate, urbanization, traditional agricultural sectors which produce traditional low value agricultural products that demand huge volumes of water, and inefficient marketing and food processing systems.
6. Despite the huge area of land in the NE region, the total arable land consists of only one fourth of the total agricultural lands, estimated at 55.5 million hectares in 2008.
7. One of the demographic characteristics of the NE region is the high population growth and fertility rates. The total population has increased from 285 million in 1995 to 380 million in 2010, and expected to increase to new record number to reach 445 and 502 million, by the years

2020 and 2030, respectively. This would mean putting too much pressure on the limited natural resources of the region to produce more food and to meet the increasing demand on water for other purposes.

8. The level of agricultural production in NE region varies from one country to another depending on the land and water resources, climatic conditions, labor skill, capital investments and other socioeconomic factors, but it is generally low, and therefore the region is characterized as one of the major food deficit and food importers in the world.

## **II. Estimates and Technical Causes of Food Losses**

9. Food losses vary depending on the commodity, year, infestation magnitude, storage type, drying method, nature of the value chain (e.g. traditional versus vertically integrated into supermarkets versus small scale retail), product handling and preservation techniques, transport and distribution systems, social and cultural eating habits, the competitiveness of the industry and its responsiveness to local, regional and global markets; among other factors.
10. Because they are very difficult to measure, much less is known about qualitative losses such as loss of nutritional quality, caloric value and consumer acceptability of the products than about quantitative losses.

### ***Cereals grains***

11. Annual losses in grains in the NE region are estimated at more than 16 million tons, which is enough to feed between 70 and 100 million people.
12. Total losses in wheat in Egypt, as an example, from harvesting until baking are estimated at 13 to 15 %, which is approximately 2.5 million tons. Several studies in the past decades in Egypt documented the losses that occur in the rice supply chain as about 25%. Estimated losses at the farmer's and merchant's level ranges from 4-10% for grain and pulses and equals 20-50 million \$US annually. Rodents, insects and birds are major causes of losses in quality and quantities of stored grains in Egypt. Estimated annual losses caused by rodents alone are about 4-10% in weight of stored grain. Estimated losses due to pest damage alone were 3.7% of the annual production of cereal grains.
13. The capacity for the proper storage of most grains and cereals in the NE region is very limited and the majority of farmers store their grains under traditional conditions. In Egypt, for example, the amount of accumulated wheat in 2011, as per the Ministry of Agriculture and Land Reclamation (MALR) announcement, was 4 million tons, in addition to around 4 million tons of imported grain. Yet the total storage capacity is only for 2.1 million tons, and these facilities are

normally dedicated to the imported grains and not to the locally produced wheat, which is being stored in jute bags and in some instances in woven polyethylene bags in open storage areas.

14. Losses during maize processing are due to the unavailability of proper storing capacities at the ports of arrival, where the corn would be dumped on the ground in the open air, and losses due to weather, birds, insects and rodents are high. In the past years some modern grain storage facilities were established. However, there are not enough maize storage centers that have dryers or silos to store the locally produced grain. Available silos are only used for the imported corn with low moisture content; while the local produce is sold as fast as possible to avoid deterioration during storage.
15. Processing of rice in the Near East is mainly done in Egypt which has over 600 registered rice millers that process over 2 million tons of paddy rice. Most millers attribute rice losses to quality of rice, moisture content and the type of milling machine used. Some machines yield low quality rice with lots of breakage. Losses due to milling could be lower should new machines and well trained personnel are available.
16. A recent assessment of rice post harvest losses showed that manual harvesting and tractor threshing results in 2.5% losses compared to 1.4% with combine harvesting. In addition, the longer the storage period the higher the breakage percentage with 3 month storage results in 2.9% losses and 5.4% with 12 month storage. Moisture content of the rice grain was another important factor in increasing the breakage, with 14% moisture causing 5.3% losses compared to 9.3% at 20% moisture.

### ***Pulses***

17. Dry broad beans, chickpeas and lentils are very important food crops in several countries of the NE region. Production of these pulses does not meet demand and hence the region imports over one million metric tons of pulses every year (FAOSTAT, May 2005).
18. Very limited data are available on the losses of pulses in NE region. Rats and mice can cause considerable losses during storage. Insect infestations, mainly due to beetles of the family *Burchidae*, cause considerable damage. Estimated losses of cowpea range between 3.4 to 5.4%.

### ***Horticultural crops***

19. Fruits and vegetables are very perishable and suffer high postharvest losses, varying greatly among commodities, production areas, and seasons.
20. Estimated losses in Iran ranges from 35 to up to 70% from the 44 million ton of produced commodities, which if saved can be used to feed approximately 20 million humans. In Saudi Arabia, the postharvest losses during marketing of tomato, cucumber, figs, grapes and dates were estimated as 17%, 21.3%, 19.8%, 15.9 % to 22.8%, and 15%, respectively.

21. General causes of losses include financial, managerial and technical limitations in production practices, harvesting techniques, and postharvest handling technologies.
22. In most NE countries one can observe examples of modern and well managed postharvest handling facilities and technologies for horticultural perishables, but they are mostly for export markets. On the contrary, one can observe very poor examples of handling of local produce which lead to many possible causes of losses and lack of produce safety.

***Animal source foods (dairy, meat, poultry, fish)***

23. The rise in per capita GDP in most NE countries, high population growth rates, and expanding urbanization have increased demand for animal source foods (ASFs). Most of the NE countries are ASF deficit with countries like Saudi Arabia and UAE importing livestock at a cost of US\$ 1-2 billion each year.
24. The magnitude of waste in ASFs in NE region is significant; 13.2 % for meat, 28% for fish and sea food and 18% for milk. The loss of eggs is high along the chain with almost equal percentage of loss estimated during retail (10%) and consumption (15%). The loss is encountered all along the postharvest food supply chain. Based on a recent FAO fish losses report, 6.6, 5, 9, 10 and 4% are lost in NE region during production, handling and storage, processing and packaging, distribution and consumption, respectively.
25. Overall, the loss of ASFs during handling, storage, processing, packaging, distribution and consumption in NE region is significantly higher than the loss during production.
26. The types of losses and waste in ASFs were reported recently by FAO as follows:
  - Production (animal death during breeding, discarding fish during fishing, decreased milk production because of cow sickness (mastitis);
  - Handling and storage: Ruminants: death during transport to slaughter and condemnation at slaughterhouse. Fish: spillage and degradation during icing, packaging, storage and land transportation. Milk: spillage and degradation during transportation between farms and cooling centers, factories and distribution centers.
  - Processing: trimming spillage during slaughtering and other industrial processing. Fish: industrial processing such as canning and smoking; for traditional such as sun drying and packaging;
  - Distribution: Losses and waste in the market system e.g. at retailers, wholesalers and supermarkets;
  - Consumption: losses and waste at household level, restaurants, hotels, street vendors.
27. Post harvest losses of meat and poultry in the region are mainly caused by poor husbandry practices and lack of compliance with food safety measures that lead to rejection and destruction of large quantities of the whole or part of the carcass, or subsequent processed food product. A key challenge in NE countries is the extreme and lengthy hot dry months, where lack of adequate

chilling needed to reduce microbial growth is a major cause of spoilage for meat and poultry. A number of Near East countries (e.g. Gulf States) enjoy modern and state of the art cold chain facilities, but most other countries lack adequate facilities.

28. The magnitude and causes of dairy losses differ between the traditional, emergent (semi-commercial) and commercial systems. The milk produced through the traditional village and pastoral operations are mostly consumed fresh on a daily basis, or sold raw to nearby shops and neighbors who do not own milking livestock. The remaining is processed into sour milk, yogurt, cheese and ghee. The magnitude of health risks in this type of operations is much higher than the magnitude of loss.
29. The emergent semi-commercial systems which are run by local cooperatives and farmer organizations depend on cold storage at the milk collection sites used by the small farmers who own less than ten milking cows. The small dairy farmers in NE region transport milk to the cooling centers by pickups, carts, motorcycles or bicycles. More well-off farmers who could produce up to 200 kg of milk may have their own cooling tanks (e.g. 10% of Tunisia's 112,000 dairy farmers). In most of these operations, the milk is transported to the cooling centers without refrigeration, which can be a major cause of loss and waste due to growth of microorganisms. In most countries, the small village dairy plants lack cooling and freezing chambers, but some entrepreneurs along the value chain operate cold transportation tanks. On the other hand, farmers in the Gulf States use highly advanced cooling vehicles to transport milk to the processing plants.
30. Losses in fish and seafood are the highest for all of the ASFs (26 – 48%). Losses are highest in the artisanal and the small-scale commercial systems, and are mainly due to inability of the distribution systems to cope with market fluctuations, physical loss of discarded fish, lack or poorly functioning cold storage facilities, and lack of basic hygiene during marketing and at home. Processing, packaging and distribution result in about 69% of the total waste of fish.

### **III. Policies and Strategies for Reducing Food Losses and Waste**

31. Strategies for reducing food losses and waste include changes in technologies and technical practices as well as policies in the agro-industrial sector. Recommended strategies will differ depending on the level of current development of institutional support and infrastructure, as well as scale of the operations and the type of food product.
32. Strategies for reducing food losses and waste include:
  - 1) application of current knowledge to improve food handling systems and assure food quality and safety;
  - 2) removal of key socioeconomic constraints;
  - 3) capacity building and training for all stakeholders, including farmers and consumers;

- 4) better marketing systems and adequate infrastructure;
- 5) improved research and development capacity;
- 6) give special attention to the constraints faced by small-scale operations.

### ***Food handling, safety and quality management***

33. In most cases the solutions to the existing problems require the use of already available information and the application of available proper technologies rather than conducting new research or developing new technologies. Government policies and interventions are needed to promote and facilitate the use of known practices and relevant technologies.
34. Specific technical practices that might be promoted for reducing losses and waste of food crops include:
  - drying grains to reduce moisture content to below 8%;
  - effective insect dis-infestation;
  - storage temperature management;
  - maintaining storage relative humidity;
  - proper sanitation procedures to reduce microbial contamination and avoid mycotoxin formation.
35. Losses of all foods can be greatly reduced with establishment of appropriate scale cold chain and other technologies and management strategies, and application of safe practices at the national, village and household levels.

### ***Socio-economic constraints***

36. The followings sectoral actions and strategies to reduce socio-economic constraints could assist in the reduction of waste and loss:
  - promote the development of effective value adding steps on the commodity value chain that provide sufficient incentives to producers through enhanced competitiveness and access to markets;
  - assure public/private sector collaboration and sharing of investment costs and risks;
  - support integration of the public and private sectors in reducing food loss as means of improving food availability and reducing food insecurity;
  - raise awareness of the traditional producers about the causes of waste, and enhance their capacity and knowledge about the best practices to reduce it;
  - develop food loss information systems in each country;
  - promote business development services (BDS), including training and exposure to formal contracts and practices for improving marketing linkages;

- clarify issues related to contracts, starting with whether or not legal contracts are in use, and if they exist, issues such as fairness, transparency and enforcement;
  - enhance access to credit, beginning with whether it is available for rural enterprises at all, and if so, what are the prevailing terms, interest rates, and collateral needs.
37. Using a value chain approach can help identify key actors and issues, especially those related to cultural and socio-economics, policy and finance. The value chain approach is considered a necessary tool for assessing postharvest losses, since while at any one point along the supply chain losses may appear small, the cumulative figure across the entire value chain could be quite significant.

### ***Capacity building and training***

38. There are many potential levels of information use – from awareness, knowledge, to application, and adaption – and there are many potential innovation strategies that learners can use to solve new postharvest handling problems as they arise. Starting with young people (in vocational education programs), and especially targeting at-risk youth and the rural poor, can help provide job skills and opportunities. Capacity building efforts that target women can assist them to improve their socio-economic status as well as their educational level.
39. Topics of capacity building and training priorities should include:
- basic practices for reducing food losses and waste;
  - technical subjects (postharvest handling, refrigeration/cold storage, transport, food processing, food quality and safety, etc);
  - value chain development (processes and practices);
  - hygienic production and safe food handling practices along the chain
  - management topics (managing labor, equipment, finances, risk, marketing, etc);
  - logistics (interactive complexities of managing a system);
  - engineering (design, modifications, repairs, maintenance).
40. Capacity building efforts need to consider many of the socio-economic issues and factors known to affect the readiness and ability to adopt improved handling and agro-processing practices and include:
- educational levels (literacy, numeracy);
  - scale appropriateness (expected cost/benefit ratio and “return on investment, ROI” for users);
  - gender neutral programs (and/or those targeting women specifically);
  - training needs of both skilled and/or unskilled labor .
41. Capacity-building efforts undertaken in postharvest technology in NE countries must be comprehensive, including technical knowledge on handling practices, research skills, access to tools and supplies, cost/benefit information, extension skill development, internet/web access,

and provision of follow-up mentoring for young professionals after formal training programs have been completed. Since training and capacity building needs will shift over time as changes occur in the food value chains, continual formative evaluation to improve programs is needed to ensure that capacity building efforts continue to meet the needs of NE target audiences.

42. Extension and training targeting producers and processors including practical demonstration studies are needed to apply integrated crop management (ICM) approaches: good agriculture practices (GAP), good postharvest management (GPM), good hygienic practices (GHP), as well as good manufacturing practices (GMP).

### ***Marketing systems and infrastructure***

43. There are too few wholesale, supermarket and retail facilities providing suitable storage and sales conditions for food products. Wholesale and retail markets in the region are often small, overcrowded, unsanitary and lacking cooling equipment. The general lack or inefficiency of these facilities is the cause of high food losses in NE countries.
44. Since it is difficult to market perishable foods without paved roads suitable for large vehicles connecting production areas with ports or domestic city centers, roads are major investment required to reduce food losses. Basic infrastructure (roads, power, water, etc) is often too large for individual investors, and requires public sector investment. Because it is difficult if not impossible to process staple foods or store perishable foods without reliable power and water, government assistance in these key areas is a prerequisite.
45. The objective for developing and utilizing market information systems (MIS) is to provide increased transparency of prices in different markets. The high cost of information makes access more difficult, particularly for smallholders. There are also issues of whether MIS systems are based upon public or private sources of information, and whether these are reliable, accurate and timely. Private sources of MIS tend to score well on these factors, but can be very costly, while public sector generated MIS can be less expensive but may be inaccurate or published too late to be useful to the marketer.

### ***Research and development capacity***

46. Universities and research centers in the NE region deal mainly with agricultural production and very little with postharvest. Extension services, private sector and NGOs in the region are not well connected to research. Extension education programs are still mostly focused on production issues and rarely take on postharvest issues. Young professionals have limited exposure to existing practical/field based knowledge, networking, conferences, and journals due to their high cost.
47. Both basic and applied research are needed on technologies for reducing food waste, but applied research has better chances for quicker utilization to solve current problems. Applied or adaptive

research should focus upon new applications of existing technologies, and seek new and successful technologies being used elsewhere.

48. Establishing a Postharvest Working Group in each country could be very useful in providing a forum for communications among all those concerned, and the next step is to establish a link among the various Working Groups to facilitate exchange of information and regional collaboration.
49. Effective communication, coordination and collaboration among research, extension, and industry personnel involved in the postharvest system are the key to solve the problem of food losses. Promoting better linkages and improved communication among the many actors in the agro-industrial sector would serve to reduce duplication of efforts and increase the adoption of cost effective food loss prevention practices.

### ***Challenges faced by smallholders***

50. There are a wide range of socio-economic characteristics, which make it more difficult for smaller scale farmers and processors to reduce food losses. These include:
  - farm type – subsistence versus market oriented;
  - land ownership – in many cases lease or share-cropper status;
  - educational level – often lower literary and basic math skills;
  - gender related roles and workload;
  - lower standard of living – relates to wealth and health;
  - lower social rank, prestige, social networks.
51. While the vast majority of food producers, traders and marketers are small-scale, there often is a policy biases toward pro-urban poor and pro-larger scale agri-businesses. Strategies to address food losses therefore need to better take into account the specific circumstances and challenges facing smallholders.
52. When focusing on exports, small producers often lack access due to insufficient quantities and inadequate food safety controls, and difficulties in meeting requirements for grades/standards, adequate technologies and knowledge.
53. When focusing on domestic market development, there are more opportunities for small scale growers and shippers but they still need specific assistance in meeting requirements of potential customers such as wholesale markets in different cities, hotels, restaurants, food service industry, processors, etc.
54. Access may depend upon literacy rates of target groups so special considerations should be given to how small producers and SMEs can participate in Business development services (BDS) programs. Legislative support may also need to be advocated for BDS to succeed, for example, it may be necessary to remove existing marketing disincentives.

55. Gender issues confound agricultural development efforts, as many small producers, farm workers and food processing laborers are women, while most extension workers are men. Cultural taboos can make it difficult for men to work directly with the women who need to learn about improved practices and technologies.

#### **IV. Regional and International Support**

56. Many of the problems and issues being faced in the NE are similar to those being encountered in other regions of the world. The NE region could reach out to existing organizations in order to better share limited resources and plan more joint projects. Regional organizations and development agencies are active in this field and would welcome the collaboration.
57. International and regional programs can serve to promote the awareness of the severity of the problem, providing educational opportunities for NE citizens and technical assistance to existing organizations involved in production, postharvest handling, processing and marketing of food.
58. Regional and global networks should be encouraged, and young agricultural professionals should be invited to join them. Collaboration among marketing associations in different countries in the NE should be encouraged i.e. JEPA (Jordan) and HEIA (Egypt).

#### **V. Conclusions and Recommendations**

59. Reducing losses is a means of improving food supply, enhancing income and assuring food security, especially in NE countries where acute resource constraints limit potential for increases in production.
60. In order to reduce such losses it is important to understand the causes and apply the proper postharvest technologies to maintain their quality and safety. There is a need for comprehensive review of the economic, social and technical factors impacting on food losses in each country of the region.
61. In order for any of these efforts to be successful in reducing food losses/waste, effective collaboration is required between the academic, industry, public and private sectors. The agro industrial sector in particular can play a key role in reducing food losses and waste, improving food availability, and thus reducing food insecurity. Each country might establish a postharvest working group, which could provide leadership and support in ensuring the dissemination of science-based information about postharvest technologies to the end users;
62. Recommended priorities for country level action include:
- support application of known appropriate technologies to improve food handling systems and assure food quality and safety;
  - assess and address key socioeconomic constraints;

- reinforce knowledge and skills of all stakeholders through capacity building and training;
- invest in developing better marketing systems and adequate infrastructure;
- improve research and development capacity, particularly targeting post-harvest product handling, storage and distribution systems;
- give special attention to the constraints faced by small-scale operations.

63. FAO can help to reduce postharvest food losses and waste in NE region by assisting interested countries to:

- Survey the magnitude and causes of losses in quality and quantity of major food products in each country in the region (establish baseline data);
- Assess locally available tools and facilities for harvesting, packaging, transport, storage, processing and marketing of each commodity;
- Determine return on investment of application of improved technologies intended to reduce losses, maintain quality and food safety;
- Disseminate information on scale appropriate postharvest practices and technologies to the end users;
- Identify problems which will need further problem solving research.