Agriculture

The history of scientific research in Israel is an integral part of the story of the return of the Jewish people to its homeland.

Theodor Herzl (1860-1904), the first to actively promote the idea of a modern Jewish state in the Land of Israel, envisaged it not only as the physical home of the Jewish people but also as a major scientific center that could revolutionize the world. This desire to transform the land, then a barren and disease ridden region, into a modern state was a key factor in subsequent scientific inquiry and technological development.

Agricultural research, specifically, dates back to the end of the 19th century with the establishment of the Mikveh Israel School (1870). The Agricultural Station, set up in Tel Aviv in 1921, eventually developed into the Agricultural Research Organization (ARO), today Israel's major institution of agricultural research and development.

Today, agriculture in Israel is comprised of plant crops, afforestation and gardening, raising livestock, and livestock products. Diversification and growth in types of plant crops and livestock breeding has increased over time. Methods of cultivation have also improved, and Israel continues to develop more efficient forms of irrigation, greenhouses, and mechanical equipment for processing and harvesting crops.

Additionally, despite the fact that Israel's georgraphy is not necessarily conducive to agriculture, Israel is at the forefront of the world in agricultural research and development. Israeli farmers and scientists have teamed with researchers throughout the world to establish new and innovative technologies to maximize efficiency, minimize waste and create greater output. They have also developed new ways of making agriculture thrive in arid and semi-arid climates such as Israel.

Research and Development

The agricultural sector is based almost entirely on R&D, implemented by cooperation between farmers and researchers.

Through a well-established extension service system, research results are quickly transmitted to the field for trial and implementation, and problems are brought directly to the scientist for solutions. Agricultural R&D is carried out primarily by the Ministry of Agriculture's Agricultural Research Organization. Most agricultural research institutes in Israel maintain close relations with the Food and Agriculture Organization of the United Nations, ensuring a continuous exchange of information with other countries.

Israeli agriculturists have pioneered agricultural biotechnology, trickle-drip irrigation, soil solarization and the sustained use of industrial waste water for agriculture. These advances have been applied to marketable products, ranging from genetically-engineered seeds and biopesticides to light-degradable plastics and computerized irrigation/fertilization systems.

Israeli-designed and manufactured computers are widely used to coordinate daily farming activities, such as guiding fertilizer injection, while monitoring all environmental factors; supplying feed for livestock mixed according to tested, least-cost, best-yield proportions; and providing a temperature and humidity controlled environment for poultry. In addition, a variety of equipment designed for tilling, sowing, planting, harvesting, collecting, sorting and packing has been developed, manufactured and implemented.

Through scientific breeding and advanced genetic testing, Israel has made itself the undisputed world leader in per capita milk production. Israel's dairy cows have increased their average milk yield per cow from 6,300 liters in 1970 to nearly 12,000 liters today, more than double the rate of the United States and United Kingdom and nearly triple that of China and India.

By harvesting sperm and ova from cattle of superior bloodlines, Israel has been able to upgrade its own herd as well as share its advances in their field with other countries, engaging in what has been jokingly called "dairy diplomacy." In 2011, for example, when the South Korean dairy industry was hard hit by an epidemic of foot-and-mouth disease, Israeli innovation was called on to provide innoculations for healthy cows and give solutions to help increase milk production in a short time period.

Agriculture has also benefited from a broad range of general scientific research and R&D developments, including automated plant tissue culture, biological insecticides, disease-resistant strains and biological fertilization.

Making optimal use of scarce water, harsh land, and a limited labor force has led to revolutions in agricultural methods. The search for water-saving techniques spurred the development of many types of computer-controlled irrigation systems, including the drip method, which directs water flow straight to the root zone of plants. As the result of intensive research, the huge underground reservoir of brackish water under the western Negev is now being successfully exploited to produce crops such as prime quality tomatoes for European and American winter markets. Research relating to the electromagnetic treatment of water to improve animal health and crop yields is also producing promising results.

One of the earliest Israeli industrial innovations to reach international markets was the drip irrigation system, based on a concept pioneered in the 1890s by a researcher in California. In drip irrigation, water and nutrients are discharged directly to the area around the plant's root system, so that much smaller amounts can be used more efficiently. This also enables farmers to provide the precise amounts of water at the rate required by different crops. Today, the system is computer-controlled. Drip irrigation has allowed the country to develop one of the most efficient water systems in the world, which it needs badly, since it uses up virtually every drop of available water each year. Israel has also become the world's leading producer of drip-irrigation systems, exporting them to Holland, the Former Yugoslavia, Australia, New Zealand, the Far East, East Africa and Central and South America.

Israel is also a leader in the development of mechanized systems used to speed up harvesting and other operations. Locally designed and manufactured computers have been developed to coordinate farming activities; these perform functions such as guiding fertilizer injection while monitoring relevant environmental factors, or supplying feed for livestock mixed according to tested least-cost/best-yield proportions.

Agriculture and the Economy

Today, agriculture represents a mere 2.7% of the Israeli gross domestic product (GDP) and just under three percent of exports, compared to an average of 30% of exports during the 1960s - the heyday of the famous Jaffa orange.

Nevertheless, despite the decline in its importance relative to other economic branches, agriculture has grown in absolute terms and played an important part in Israel's economy for more five decades. In 2010, the total

amount of land devoted to agriculture was 3,887 thousand dunams, nearly three times the amount of devoted land from 1948. Out of that area, field crops comprised 1,316 thousand dunams, vegetables 741 thousand dunames, citrus 176 thousand dunams, and aquaculture made up an additional 22 thousand dunams.

While the high-tech industry has boomed in Israel, agriculture remains of major importance, especially in areas such as the Arava and the Jordan Valley where it provides almost the sole means of livelihood. In 2010, only approximately 50,000 people were employed in farming, constituting less than two percent of the country's workforce.

In monetary terms, Israel produces around 90 percent of its food requirements.

In 2010, Israel's total input of resources invested in agriculture was 15.6 billion shekels - 31.1% for fodder, 14.3% other inputs, 12% depreciation, 12% for fuel, lubricants and electricity, 8.7% chicks, seeds and seedlings, 8.4% water, 5.8% packing and transport, 4.5% pesticides, and 3.3% for fertilizers and manure.

The country's output of final products in 2010 was 26.5 billion shekels, an increase of more than 10 billion shekels from input. This was made up by 23.4% vegetables, potatoes, and melons; 20% other fruits; 18.2% cattle, sheep and goats; 17.8% poultry; 5.5% citrus fruit; 5.3% field crops; 4% flowers and garden plants; and, 5.7% miscellaneous.

International Collaboration

Many of Israel's innovative agricultural methods and advanced agricultural technologies have been shared with the United States and other nations around the world. This international collaboration and cooperation benefits not only those countries receiving Israeli know-how to maximizing and improving their agricultural products, it also helps Israel build friendships and break down barriers that will enable it to continue to make advancements into the future.

Under the auspices of the Binational Agricultural Research & Development Foundation (BARD), Israeli, American, Canadian and Australian farmers and scientists have collaborated on more than 1,100 projects over the past three decades. This BARD-sponsored research has led to innovative developments, new technologies and renewed focus in drip irrigation, pesticides, fish farming, livestock, poultry, disease control and farm equipment. Some examples of these projects include: improving wheat-seed proteins; spray technology that reduces pesticides; control of pathogens; identification of QTL's; and, control of post-harvest decay in fruits and vegetables.

Due to the success and quick implementation of BARD projects, other collaborative programs have been set up between Israel and Jordan, the Palestinian Authority, the European Union and various states in the United States.

One such program is the International Arid Lands Consortium (IALC), which connects researchers from Israel with those in a number of universities across the United States as well as the Egyptian and Jordanian governments to work on developing and applying new applications in arid and semi-arid farming technologies. Since 1993, the IALC has funded nearly 100 projects with more than $12.4 million. The knowledge gained from this collaboration has been used to benefit countries from Kenya and Ethiopia, to Uzbekistan and Kazakhstan, to Australia and Brazil.

Agriculture and the Future

A combination of sophisticated, applied science, determination and government support have helped Israel's farmers to modernize and adapt to changing geopolitical, market and climatic conditions, creating a strong base from which to proceed in the coming decades.

Israel's agriculture continues to thrive, and supplies most of the country's food needs, though profitability in export sectors has declined sharply in recent years. Among the numerous problems the crop-growing sectors have contended with since the State was founded, water scarcity remains the principal - and growing - threat. Nevertheless the ongoing introduction of new and recycled water sources, coupled with altered irrigation methods and more water-efficient crops, promises long-term security.

By the year 2020, Israel's population is expected to grow to around 8.5 million. This will cause huge increases in demand for agricultural produce and products; but urban use of land and water will also increase enormously. The amount of fresh water allocated for agriculture was reduced radically, by 50 percent (to 580 million cubic meters), in 2000. By 2020, it is unlikely to exceed this amount, and may well be considerably less. At the same time, the amount of suitable land available for farming (360,000 hectares) will also be some 18 percent less than at present.

Part of the higher demand - notably for field crops (such as cereals, oilseeds and sugar) and for milk products, fish and beef - will have to be met by increased imports. Nevertheless a substantial part of the additional requirements will have to come from increased domestic production. Sweeping changes - like a 33% increase in the labor force and a reduction in irrigated field crops, such as cotton - will be required to make water available for growing fruit and vegetables for the local market.

A study by the Ministry of Agriculture, Israel is predicated to, by 2020, be able to increase production of agricultural goods. This is certainly consistent with historic development. Except for brief, sporadic declines, agricultural output has grown almost uninterruptedly since 1948.