FAIR & FERTILE Land

by Sandy Cash

Agriculture that works in harmony with the environment is the hallmark of research at the Faculty of Agricultural, Food and Environmental Quality Sciences


Ilan Ossendryver

Douglas Guthrie

I Prof. Yitzhak Hadar

ISRAEL is a semi-arid, land-poor country with one of the highest population densities in the world. Thus, its ability to manage and preserve its own natural resources is an absolute imperative. Nevertheless, "until the 1980s, most agricultural research did not take environmental issues into account," says Professor Yitzhak Hadar, Dean of the Faculty of Agricultural, Food and Environmental Quality Sciences.

"Today, there has been a shift: many scientists are exploring wider issues like soil and water quality, pollution, conservation, and the nutritional value of produce, instead of focusing on the yield of a particular crop plant," says Hadar whose research focuses on environmental quality, in particular the recycling of organic agricultural waste, composting of household and agricultural waste, and the suppression of soil-borne plant pathogens. "It's only by understanding the whole cycle, or chain reaction, of our agricultural practices that we can adjust these practices, and ensure sustainable farming for the future."

Researchers at the Faculty are internationally recognized as having pioneered a number of methods that are crucial to sustainable farming. These range from the development of a drip-irrigation method that revolutionized water use worldwide to the use of non-chemical methods to control plant pests and diseases, such as biological control and soil solarization, the latter an innovative technology using solar power to destroy plant-eating insects and soil-borne diseases.

Following in their footsteps today are researchers from a broad range of fields who are determined to integrate agriculture's traditional goal – to provide more and better food for an ever-increasing number of people – with the modern realization that in order to continue to reap its benefits, we must conserve and, if possible replenish the earth's resources.

The Good Earth

WITH Israel's growing population generating an ever-increasing demand for water, there is an urgent need to find alternative water sources for the agricultural sector – which accounts for 60 percent of the country's water usage. Today, many farmers irrigate their crops with household and industrial wastewater that

60 YEARS OF AGRICULTURE


Repro: Werner Braun

1918

"It is to true scientific method that we may look for the full cultivation of this fair and fertile land, now so unproductive."
Zionist leader and University founding father Chaim Weizmann at the foundation-stone laying ceremony of the Hebrew University, Mount Scopus, 1918


Alfred Bernheim

1942

1942: School of Agriculture in Rehovot opens with one building, 21 students and a teaching staff mainly comprising researchers from the Jewish Agency's nearby agricultural research station


Alfred Bernheim

1943

1944: First masters degrees in agriculture are conferred. Before starting the two-year program, candidates must spend one year on a rural settlement
1947: 36 M.Sc. students graduate

has been 'reclaimed'. But there's a catch: without strict quality criteria for recycled agricultural water, farmers run the risk of actually damaging their fields.

"Reclaimed water can literally poison the earth," says soil chemist Yona Chen, the Vigevani Professor of Agriculture who is president of the Israel Society for Ecology and Environmental Quality Sciences. "After leaving a household or factory, water carries high levels of dissolved organic matter, sodium and chloride. The organic matter can cause soil 'hydrophobicity', or the inability to absorb water evenly, while the sodium and chloride also adversely affect soil quality. We are currently attempting to characterize these problems and explore ways to solve them."

'BY UNDERSTANDING THE WHOLE CYCLE, WE CAN ENSURE SUSTAINABLE FARMING'

Another major hazard associated with reclaimed water is boron, a chemical element found in many household and industrial detergents. Although it exists naturally in the soil and, at very low concentrations, is an essential micronutrient for plant growth, boron is toxic when it reaches even slightly higher levels.

In addition to determining the level at which boron becomes dangerous, Chen has devised a boron-busting treatment based on the most ancient of agricultural arts: composting. Already world-renowned for developing a high-temperature technique that produces easy-to-spread, pathogen-free compost particles, Chen has now shown that compost absorbs boron and thus can be used to protect – as well as enrich – crops.

Chen's work has spurred the government to implement regulations to control levels of boron, and to encourage or require industrialists to treat wastewater before it leaves the factory. "We can't eliminate all the problems," says Chen, a member of the Seagram Center for Soil and Water Sciences. Farmers have already sued Israel's water authority for soil damage caused by reclaimed water, he says, "but by minimizing impurities, and adopting appropriate agricultural techniques, we can protect the soil before it is too late."

The Right Balance

IN a quiet corner of the campus, Dr. Uri Shani teaches drip irrigation in a special 'lab' – a beautiful mini-orchard he planted himself. As an expert on irrigation management, Shani knows that adding water to soil is not always a simple matter. "Irrigation entails contamination," he says. "Plants take only water, leaving salt and other additives in the ground." In the southern Negev desert, where brackish water is often used for irrigation, 16 metric tons of salt are added to each

Prof. Yona Chen
Above: the Dan Region secondary and tertiary wastewater treatment plant in Rishon LeZion is based on Faculty of Agricultural, Food and Environmental Quality Sciences research. Left: compost production at the Shaham solid waste recycling plant

1950

1952: In response to country's need for agronomists and professionals to develop land resources, student intake increased and research departments established. School upgraded to Faculty, second building added. 104 students

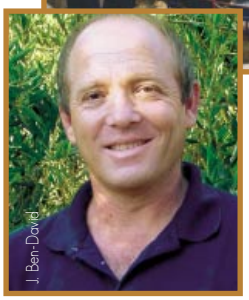
1957

1954: 200 students
1955: Three-year bachelors degree in agricultural sciences introduced.
1956: Special unit set up to train teachers of agriculture and agricultural advisers.

1960

1958: First B.Sc. degrees awarded. The Faculty's 79 undergraduates include kibbutz and moshav members training as farm and produce sector managers, agronomists and kibbutz administrators
1963: 289 students

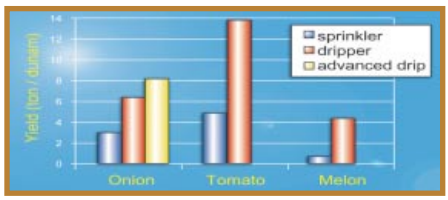

Ilan Ossendryver


J. Ben-David

dunam (1,000m²) of land per year. "Not only does this damage the soil's agricultural potential," says Shani, the Joseph H. and Belle R. Braun Senior Lecturer in Agriculture and a member of the Seagram Center for Soil and Water Sciences, "eventually the salt gets into the groundwater."

Shani's research focuses on managing irrigation in order to minimize soil damage. Using ground sensors that quantify water uptake and evaporation, and by monitoring other variables, he has shown the advantage of continuous-drip over periodic irrigation methods. Shani has also found that when farmers use reclaimed water – which is high in salts – they tend to over-irrigate. "Although they had learned from us that additional water would help their crops," he says, "in reality, they created massive salt build-ups.

"Current research, however, allows us to determine exact plant needs under different levels of water salinity; this means we can help farmers manage their irrigation, and preserve the soil for the years to come."



Dr. Uri Shani
Left: graph shows variation in yields according to type of irrigation. Above: a rotating irrigation 'carousel' developed by Dr. Shani allows accurate analysis and monitoring of irrigation levels and conditions

Fish in Water

ISRAEL is a world leader in the cultivation of 'marginal' land, such as its deserts, that was once considered unsuitable for farming.

However, the advent of farming on this land had an unexpected result: it put agriculture in direct competition with 'aquaculture' – industrialized fish-production utilizing artificial ponds dug in the once-useless land.

The increased competition for land led to the development of plastic or concrete ponds that could be put anywhere, and which allowed fish to be raised at a much greater density than previously possible. But like many economic success stories, increased production had an environmental cost.

Cultivating fish in crowded conditions – up to 150 fish per cubic meter – means that up to one-fifth of the pond's water must be replaced daily. The discharged water, though treated, contains a high concentration of polluting nitrates and organic matter.

"Freshwater fish farmers were releasing

MAKING AN IMPACT

Faculty of Agricultural, Food & Environmental Quality Sciences research has led to the development of major innovations in world agriculture


Douglas Cuthrie

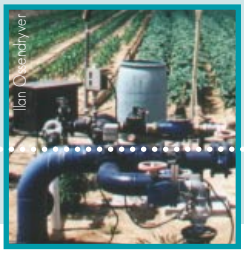
Long shelf-life tomatoes with improved taste and disease resistance, including the world's first vine-ripened tomatoes

Soil solarization, a non-chemical method to kill soil-borne pathogens and weeds


Miki Kolten

Methods to combat water and soil pollution

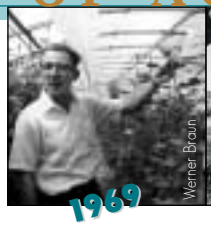
Drip irrigation and 'fertigation' technologies


Ilan Ossendryver

60 YEARS OF AGRICULTURE


David Rubinger
1964

1969: The School of Nutritional Sciences opens, offering a three-year B.Sc. degree


Werner Braun
1969


Werner Braun
1972

1973: Of the Faculty's 1,226 students, almost half are from agricultural backgrounds
1983: 1,652 students


Werner Braun
1980

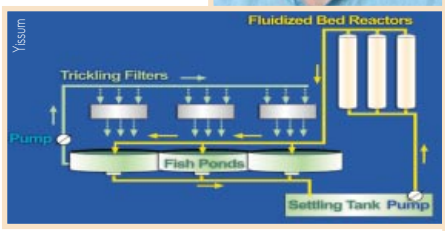

1983

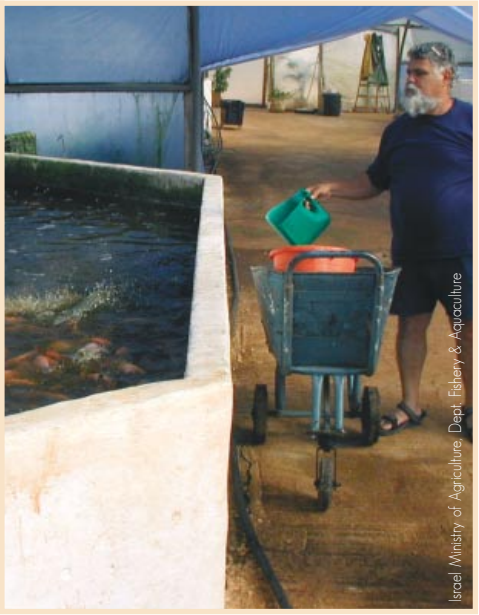
pollutants into the groundwater, while marine fish farmers raising saltwater fish in cages in waters such as the Gulf of Eilat were causing damage to the coral reefs," says Dr. Jaap van Rijn of the Department of Animal Sciences. "Obviously, we needed to find a new, environmentally-safe form of aquaculture."

Van Rijn has developed a closed system that uses bacteria to 'digest' pollutants and convert them into harmless gases that are released into the atmosphere. His closed system saves water as well: "Rather than flushing the system with clean water, all of the water is recycled," he says. "The only water loss is due to evaporation."

A semi-commercial freshwater pilot plant, developed by van Rijn in cooperation with Yissum, the Hebrew University's research development company, has been in operation on the shores of the Sea of Galilee since 1995; two seawater pilot plants in Rehovot and Eilat have been in operation for the past three years. The plants allow annual fish yields of over 100 kg per cubic meter, use 50 times less water than would be required by conventional ponds, and create no pollution whatsoever.

Still, Dr. van Rijn believes it will require government legislation to convince fish farmers to think 'green'. "My system requires a higher investment than regular ponds and is technically more complex," he says. "But it saves land and water – neither of which Israel can afford to waste."





Dr. Jaap van Rijn
Diagram showing Dr. van Rijn's technology, right: breeding St. Peter's fish (tilapia) in closed-system concrete pools, Moshav Hamra, Jordan Valley

Out of Space

SO how much land and water is left in Israel? If you're talking about undeveloped, non-cultivated areas, the answer is: not much. With more farmers abandoning their fields and poorly regulated development speeding 'urban

Restoration of scent to hothouse flowers

Biological pest control agents

Optimal conditions for poultry farming

Waste-water and solid waste recycling technologies

1985: Koret School of Veterinary Medicine opens in Rehovot
1986: Division for External Studies established, offering short- and long-term courses for foreign students, mainly from developing countries

1988: Veterinary Teaching Hospital opens at Beit Dagan

1995: Faculty renamed Faculty of Agricultural, Food and Environmental Quality Sciences
1997: English-language masters program in agriculture for foreign students opens

sprawl', Israel is in danger of losing its natural landscape forever. The solution, says agricultural economist Dr. Aliza Fleischer, is to start thinking of open spaces as a precious natural resource.

"What's happening in Israel is common to all developed countries," explains Dr. Fleischer. "Rural land is being sold to developers, but at the same time higher standards of living mean that there is greater demand for recreational space – the very same space that is fast disappearing."

Only recently has Israel begun to recognize the importance of open space and its associated uses such as leisure activities and rural tourism, says Fleischer.

'THE SOLUTION IS TO START THINKING OF OPEN SPACES AS A PRECIOUS NATURAL RESOURCE'

"The EU subsidizes farmers, not just because they produce food, but also because they provide a recreational escape for city folk. In Israel, we are lagging behind; although some subsidies have been obtained for rural tourism, unlike in Europe there are none directly designated for 'landscape services' where the determinant for funding is the natural environment."

Fleischer, in cooperation with Department of Agricultural Economics and Management colleague Professor Yacov Tsur, develops models to determine the value of open space. "National and urban parks, beaches, and even the fields we drive past are valuable because they help prevent us from feeling that we live in an endless concrete jungle. This must be factored into the equation as we make decisions," says Fleischer.

Her job is to assess the utility of open spaces, and translate it into dollars and cents. "For instance," she says, "when we looked at the financial returns from farming fields in the Hula and Jezreel valleys, we found that they are less than the value elicited from them as landscape services.

"Today, there's a wide consensus that we need to preserve our open spaces," says Fleischer. "But the open question is: who will foot the bill?" ■

Above: Dr. Aliza Fleischer
Right: winter landscapes in Israel: in developing models to determine the value of open space, Dr. Fleischer takes into account the impact of climate change on landscape and the resulting value of its utility

60 YEARS OF AGRICULTURE

2002: Establishment of the Robert H. Smith Institute of Plant Sciences & Genetics in Agriculture; construction of new building for Institute progresses

2002: The Faculty remains Israel's only university-level institution of agricultural education and research, with 120 faculty, 10 interdisciplinary research centers, and 2,200 students in six degree programs, as well as a teaching certificate program