40. Drip irrigation: Daniel Hillel's legacy

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Did a vigorous solitary tree in the middle of a dry patch of land in Palestine (later to become Israel) inspire the most significant modern innovation in irrigation methods? Did Simcha Blass or Daniel Hillel catch sight of the tree and then have a look underground, discovering a pipe that was leaking drop after drop at the roots of the tree? The answers are somewhat contradictory. It is clear, however, that in the late 1950s and in the 1960s, both men, working in arid conditions in Israel, pioneered drip irrigation (also called micro-irrigation), taking advantage of another innovation at the time – cheap plastic tubes.

In November 2012, Daniel Hillel received the World Food Prize at the University of Iowa. In an interview with *The Wall Street Journal* (October 15, 2012) he recalled the early days of drip irrigation in the Negev Desert: “We realized through drip irrigation, by applying water to the rooting zone of crops very gradually, drop by drop, the soil is never saturated nor ever allowed to desiccate. Consequently, the system becomes more sustainable, water is used more efficiently and farmers could get much more crop per drop” (Rai, 2012). Less water and richer harvests, it was indeed a revolution in agriculture.

Simcha Blass had his own system patented in the traditional way. Daniel Hillel made his freely available, contributing personally to the adoption of drip irrigation in more than 30 countries, including neighbors of Israel such as Jordan and Egypt. Drip irrigation is by no means convenient for all crops; even for suitable crops, it is not universally adopted by farmers, but it is nevertheless practiced on a large scale in countries on all continents, including parts of China, India and the USA.

Drip irrigation systems can be very simple and inexpensive, with only basic components that can be made from recycled materials and function under Newton's law of gravity; in this way they are affordable to poor farmers in countries like Bangladesh, Burma or Zimbabwe. They can also be sophisticated, with all sorts of monitoring devices.

Technical sophistication is not an aim in itself, but it is efficient in suitable circumstances. Farmers in the High Plains of Texas privately own, according to the law of the state, the portion of the Ogallala Aquifer beneath their land (whatever that might mean); they interpret such ownership as a right to pump at will. Farmers in Nebraska use the water they extract from the same aquifer

(it extends from Texas up to the Canadian border) in a radically different way: they put to good use a sophisticated irrigation system designed by the German engineering firm Siemens. Sensors are scattered across the fields that capture information about two key parameters: soil moisture on the ground and temperatures at the top of plants; this information is transmitted to a central computer that processes it in order to fine-tune the amount of water delivered to the plants. Pioneered by a few farmers in central Nebraska, the system has been tested and validated by experts in irrigation from the College of Agricultural Sciences and Natural Resources at the University of Nebraska. It has then been picked up by numerous farmers all over the state. The college has acted as mediator in adoption.

Beyond innovation in monitoring systems, social and organizational innovation also plays a critical role, to ensure that the total withdrawals from aquifers, even through very efficient irrigation techniques, do not in the end exceed the carrying capacity of the natural resources. Institutions to manage water as a common good, as existed traditionally in water-scarce communities around the Mediterranean (oases and their water rights schemes, for instance), had been challenged greatly by the capacity of individual farmers to drill their own wells and use diesel pumps at a low price, leading to rapid depletion of these resources. Re-establishing the social capital of groups of water users at the local level is a complex challenge: it took drip irrigation tomato producers in the Sahel region in Tunisia some time to complement the technical innovation they had adopted with a governance institution to limit the amount of water they were allowed to use, but it now ensures much more predictability and thus mid- to long-term economic profitability. The Tunisian government had established the legal status of *groupements d'agriculteurs* to enable such an institution to flourish, but it takes local social innovators to make them real.

In Iran, a lonely innovator demonstrated the value of drip irrigation in desperate circumstances. In this country, farmers irrigating their fields without restraint and engineering firms, owned by the Islamic Revolutionary Guards Corps, damming every other river (at least those that are not yet completely dry), are busily helping climate change to condemn the country to aridity. The fate of Lake Urmia, the Iranian counterpart of the Great Salt Lake in Utah, is reminiscent of the destruction of the Aral Sea during the rush to cotton in Central Asia under Soviet rule, with the same dust storms evolving from the parched lands. Most of Iran is now in the grip of what looks like a never-ending drought. Water management routines, which essentially boil down to depleting aquifers, don't prepare the country to face a trend that will become all the more severe as climate change advances. Actual desertification is on the march in Kerman province in Southeast Iran, which is sometimes referred to as "pistachio land". Farmers there used to waste (subsidized) water by lavishly flooding their trees in the middle of the day. One of them became the laughing stock of

his neighbors when some years ago he invested in a relatively costly drip irrigation system. His orchards are now the sole green spot in a landscape of dead trees: he is the only one who can survive on today's meager water allocations.

REFERENCE

Rai, N. (2012), "Drip, drip, drip: Daniel Hillel talks about how he helped revolutionize the way farmers water their crops", *The Wall Street Journal*, October 15.