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Brackish and Reused Water for the Desert

Arthur D. Kahn

In 1949, at the age of nine, the current director of Israeli saline irrigation research, Dov Pasternak, arrived in Israel with his parents who abandoned a prosperous shoe manufacturing business in Bahia, Brazil. In 1956, while attending an agricultural secondary boarding school, Pasternak went on an excursion to the Negev. Then and there he decided that he would become a desert scientist. In 1964 and 1965 he worked in the Arava valley between the Dead and Red Seas, doing research on drip irrigation, then newly developed by the Israelis. Subsequently, while a doctoral student at Queensland University in Australia, Pasternak came upon a book by Hugo Boyko on saline water irrigation. A research scientist at what was then called the Negev Institute for Arid Zone Research, Boyko discovered that certain plants possessed a mechanism for coping with salt and were susceptible to saline water irrigation. Impressed by Boyko's research, Pasternak chose halophytes (salt-resistant plants) as the subject for his doctoral research.

In 1971 Pasternak obtained an appointment to the Negev Institute, where Boyko was still active. Three years later, upon the establishment of the Ben-Gurion University of the Negev, the institute became the Boyko Institute for Agriculture and Applied Biology in recognition of financial support from Boyko's brother, a wealthy New Yorker.

When Pasternak joined the institute, it was still assumed that saline water could not be employed in irrigation. In collaboration with the Ben-Gurion University department of Chemical Engineering, world-renowned for its work on desalinization, and with United Nations funding, the Boyko Institute sought to develop a practicable method of desalinization for arid zone agriculture.

The cost of desalinization proved prohibitive for extensive irrigation, and it was necessary to experiment with brackish water. Pasternak collaborates with Joel Demelach, an immigrant from Italy, graduate of the Hebrew University and member of the first kibbutz established (in 1943) south of Beersheva. Their collaboration, between scientist and farmer, theoretician and practitioner, exemplifies a general practice in Israel of gearing research to immediate problems of the society.

On four hectares (approximately four times 2.471 acres) purchased by the Jewish Agency from the Regional Council of the Central Negev, Pasternak and Demelach began saline water experiments with crops known to be among the most salt tolerant, cotton and wheat. Initial experiments failed because of the rusting of metal irrigation pipes and leaf scalding. A comprehensive approach to the problem, Pasternak realized, was necessary, with preliminary large-scale field experiments and an intensive study of plant growth processes and of soil physics. In 1981, with the establishment of the 50-hectare Ramat Negev Agricultural Experimental Station (RNAES), Pasternak and Demelach undertook research into all the problems involved in saline water irrigation. They discovered "that different crops should be evaluated under different salinity levels according to their sensitivity." Pasternak developed "equipment capable of producing mixtures of water of any possible salinity and even for shifting from one level of salinity to another."

With a team of associates, Pasternak evolved specific agro-management practices for saline irrigation. Drip irrigation, they found, is superior to sprinkler and surface irrigation. In addition, the quantity and frequency of irrigation has to be established for each crop. After small-scale experiments, they achieved success beyond their expectations. The cotton crop was superior to one grown with fresh water. In the competition between the fruit and the leaves and stem of the cotton plant, salinity supports the vegetation so that all the nutriment goes to the fruit. Of 30 forage, grain and field crops selected and bred for salt resistance, Pasternak and Demelach recommend approximately half for commercial production with saline water irrigation. In addition to cotton, they achieved particular success with sugar beets, asparagus, wheat and barley. Tomatoes, rye grass, brassicas (turnips, cabbage and broccoli), celery and onions form a second class. Among orchard products, olives, pomegranates, grapes and, surprisingly, pears have responded well. Response was poor, on the other hand, with peanuts, beans, peppers and sweet potatoes.

Israeli farmers are employing saline water irrigation profitably with tomatoes and melons as well as sugar beets, wheat, pomegranates and grapes. In the Negev, farmers obtain a yield of 1,600 tons of tomatoes on a 200 hectare plot, "and that yield, substantial for a small country," says Pasternak, "will be increased." With machine-harvested tomatoes, saline irrigation improves color and firmness and reduces occurrence of green shoulders. The yield suitable for peeling is double that obtained with fresh-water irrigation, and canneries pay a bonus for these superior tomatoes. Israeli salad tomatoes cultivated with saline water fetch twice the price of Spanish or Florida tomatoes in European and United States markets, and Israeli melons are highly prized.

Varieties of additional crops are being screened, and hybridization is employed to improve salt tolerance. With each crop it is necessary to discover at what stage of development fresh water irrigation must temporarily replace brackish water, that is, at which point salinity

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proves damaging. Maize, for example, is salt sensitive at an early stage; lettuce, at a later growth stage.

When Pasternak began his research, there were only three settlements in the Negev, and the government decided to discontinue settlement because of the water shortage. Success with saline water irrigation changed the situation. Two wells were dug in the Negev. In the west, water was reached at 100 meters, and cotton farming was introduced. Plans were drafted for an additional 15 wells. For new agricultural settlements, the Jewish Agency now projects an irrigation ratio of two-thirds saline and one-third fresh water.

Currently, four settlements are using saline water. Approximately one-half the Negev, according to Pasternak, is adaptable to crop production. With saline water irrigation, he says, some 2,000 settlements of 100 inhabitants could be supported in agriculture along with two or three times that number of people in subsidiary employment. When the Likud party came to power, however, the establishment of additional Negev settlements was halted.

Pasternak estimates that with exploitation of the two main brackish water acquifers along with a smaller one recently discovered, Israel could reduce its general consumption of fresh water by 10 percent and of the fresh water employed in agriculture by 20 percent. The acquifer originating in the Judean hills and flowing south-southwest lies 200 to 300 meters below the surface and reaches a depth of some 800 meters. When a hole is drilled to the aquifer, water rises to within 300 meters of the surface, at which point it must be pumped. Technological improvements in the early '70s enabled drilling to depths of thousands of meters, and wells were dug in the aquifer for irrigation in the Negev highlands (Ramat Ha-Negev).

In January 1972 the pump at the experimental desalinization plant broke down. Pasternak plunged into the pool to repair it. The water was hot. The plant director said it reached 40 degrees centigrade and that water from another well was even 20 degrees warmer. Pasternak saw the possibilities in exploiting the heat source. Burying plastic pipes at a depth of 30 centimeters, he directed the warm saline water to plant roots, accelerating growth and obtaining earlier yields. Cucumbers and melons, especially, thrived with this technique.

Six years later Pasternak began heating greenhouses by pumping water into a cooling-tower where fans continuously circulated air through convectors containing warm water. In addition, with a curtain of water streaming through layers of plastic above the plants, he controlled leaf temperature more effectively than by the standard ambient air heating. During the day he cooled the greenhouse by passing cold water through layers of plastic on the roof. The water curtain functioned also as an effective solar collector. By coloring the water, Pasternak transmitted visible radiation and absorbed long-wave radiation. The energy required for this technology was only one-tenth that employed in conventional heating.

Collaborating with Pasternak and Joel Demelac saline water irrigation projects is Gideon Oron of Unit for Salinity and Water Engineering of the Blaus Institute for Desert Research. Oron's parents, expelle students from German universities, fled to Israel in early '30s and joined a *moshav* (a settlement of pri farms working as a collective) composed of German in lectuals. On the farm Oron enjoyed an idyllic childho After military service in the early '70s and doctoral w at the Technion in Haifa, Oron did postgraduate work waste water research at the University of Colorado at Collins. Then after brief stints at the Technion and in vate industry, he received an appointment at the Instit for Desert Research. He immediately initiated resea projects on the use or reuse of marginal water source the desert. After passage through treatment plants, sewage of Beersheva, the largest city of the Negev, pumped out for sprinkler or drip irrigation. Increasing waste water is being used in subsurface irrigation wi polyethylene pipes set 10 to 12 inches below ground. T soil acts as a filter so as to eliminate health problems. Tl subsoil waste water irrigation has proved effective wi alfalfa and with processed foods. Experiments are now process with raw vegetables.

On a two-hectare plot at the center of 500 hectar belonging to two kibbutzim, Oron and his unit engage a "constant interplay with the farmers, for we are workir *with* and not *for* them," many of whom, according Oron, like Joel Demelach, read scientific journals an exhibit a high level of scientific sophistication.

The Israelis rely on fish ponds for half their needs. Fis can be raised in brackish water. Since fish waste accum lating in the ponds eventually poisons the fish, Oron ha been seeking an effective treatment of the water eithe for recirculation in the ponds or for irrigation. With th assistance of four students from the Netherlands, Oro was experimenting with sowing fish ponds with duck weed, a floating plant easy to harvest and useful as fodde for animals and chickens as well as fish.

In a course on economic modeling, Oron supervise undergraduates in field feasibility studies. Recently two Israeli Arabs analyzed the economic effectiveness of sub surface irrigation of alfalfa; two other Israelis investigated eel farming with saline water as a delicacy for export.

For six years Pasternak experimented unsuccessfully with the development of halophytes for fodder, using a mixture of brackish water and sea water (which has 10 times the salt content of the water in the Negev aquifers). Pasternak found that with this halophyte fodder, animals not only had to imbibe a large quantity of fresh water to eliminate the salt but that the net energy from the fodder also was low. With funding from the United States Center for International Agricultural Development Corporation and in collaboration with the universities of Lisbon and of the Algarve, Pasternak is continuing his investigation solely with brackish water, seeking to develop fodder production in 10,000 hectares of salt marsh in southern Portugal. A Portuguese technician joined Pasternak's team in Israel for six months of study and practical experience.

Dr. Odera, the director of the Kenyan Salt Areas Research Institute, visited Pasternak to draft plans for collaborative research in the development of fodder halophytes in salt marshes on the border between Kenya and the Sudan and Ethiopia to serve nomadic peoples especially in times of drought. After six months of study of Israeli saline water irrigation, a Dr. Muturi was appointed director of the Kenyan-Israeli joint fodder development project.

Dr. J. Chweya of the Department of Horticulture of the University of Nairobi spent three months at the Boyko Institute working on a project for optimizing Kenyan vegetable production. Two Israeli scientists, in turn, visited Kenya to coordinate research activities. The Koret Foundation of San Francisco has established an annual Boyko Institute scholarship for a Kenyan senior resident scientist. Projects for the cultivation of fodder shrubs are underway in both Kenya and Botswana. A Botswanan technician completed a one-year training course in range management in Israel, and another Botswanan received training in Israel on fruit and nut cultivation. A research program is under way for the propagation of cashews in Senegal. In 1988 Pasternak and Meir Forti spent a month with a German-Israeli mission in the Chaco of Paraguay to produce a comprehensive development plan for the region, and a trinational seminar on the project was held in Israel in December 1988.

India and Pakistan both have indicated interest in collaborative projects with the Israelis, and Pasternak is confident that eventually China and Russia, both with large desert regions possessing saline water aquifers, will request assistance from the Boyko Institute.

The Boyko Institute participates in numerous international collaborative projects. "Today," declares Pasternak, "we can recommend crops and technologies that allow agricultural production with water of up to 10 percent of sea water salinity. We are convinced that in the future, water of even higher salinity will be used, opening new horizons for salinity-based agriculture in deserts of the Middle East and throughout the world."

Like Reuven Yagil, the animal husbandry researcher specializing in camels, ostriches and goats for arid zone production, Dov Pasternak is an active participant in CALAR (the Cooperative Arid Lands Research Program), established in 1980 after Congressman Henry A. Waxman of California promoted a $5 million Agency for International Development (USAID) appropriation to encourage scientific cooperation between Egypt and Israel. The largest component of the enterprise is salinity research.

Although soil conditions and water resources differ significantly in the two countries, useful cooperative research on salinity has been conducted. Scientists of the countries are collaborating in experiments with saline water irrigation in loess (soil carried by wind from sand dunes) and have achieved success with cotton and asparagus crops. At an evaluation meeting in San Diego, a decision was taken for joint publication of books on salinity and animal husbandry, a novel effort in cooperation between the two nations. Under an initiative of the Albert Einstein Peace Prize Foundation funded by the United States Agency for International Development, with Pasternak serving as coordinator, a project is under way to apply the most advanced Israeli and international arid zone agricultural technology in the establishment of settlements in the Egyptian western desert for Egyptian university graduates (a large number of whom are unable to find employment).

The Israelis and Egyptians have jointly applied to the USAID for funds for a collaborative effort in protective agriculture, that is, with greenhouses or other cover, research from which Pasternak has been diverted by involvement in other projects.

In a 1988 evaluation of the CALAR project by the international committee heading the study, the political significance of the collaboration was emphasized. "If this project," the statement declared, "was only a bilateral project between Egypt and the United States or Israel and the United States, it would be considered a successful project. The fact that it is a trilateral project among the three countries makes it a resounding success .... Cooperation among research organizations in the United States is difficult even where culture and language are similar. To expect close cooperation between countries where language and culture are different is even more unrealistic. The fact that cooperation was achieved to a certain extent bears witness to the effort put into this project by each of the participating countries."

On the other hand, the statement noted: "Cooperation between Egypt and Israel at the level achieved would not have occurred without "outside" funding and support, such as has been provided by CALAR. In the current context of international relations, it seems unlikely that this cooperation can be sustained if support ceases." With cuts in the appropriations for USAID by the Reagan administration and continued under the Bush administration, CALAR has, indeed, curtailed its operations.

Oron's unit accepts five to six foreign students each term for theoretical and practical experience. He has had students from the United States, Sweden, France, Spain and Belgium and expects others from Ghana and the Philippines. Under Oron's supervision, a Swede spent a year developing a simple emitter for drip irrigation that could be constructed of local materials by farmers in the Third World. "We try, explained Oron, echoing many of his colleagues, "to use advanced methods adapted to simple conditions."

In 1986 as a visitor at the Center for Irrigation Technology of the California State University at Fresno, Oron conducted research on recycling waste water as an answer both to a water shortage and to the pollution of the Kesteron River. The Environmental Protection Agency had ordered the closing of a reservoir and had forbidden farmers to dispose of drainage water into the river. Oron demonstrated the practicability of reusing saline drainage by mixing it with clean water and instituting salt-resistant crops. He showed, too, that ponds of a

mixture of waste and fresh water could serve for irrigation reservoirs as well as solar ponds for producing electricity, a technology already employed in Israel. He produced a "Users' Manual" for local farmers about on-farm management of saline waste water.

Generally, Oron is less optimistic than Dov Pasternak about the future of international collaborative efforts. Collaboration with Third-World countries requires funding either from Europe or the United States. In some instances, European or United States intervention is required to avoid direct negotiation with countries that do not recognize Israel or are otherwise hostile. He was discouraged when a cooperative program developed with Fresno State College for exchange of scientists and farmers and for cooperative research was vetoed by the governor of California.

Even in regard to the CALAR enterprise with Egypt, Oron is more reserved than Pasternak. Because of the intifada, he said, Egyptians refused to come to Israel for the last joint conference, and the meeting had to be shifted to San Diego. When he himself applied to attend a conference in Egypt, he did receive the courtesy of a reply.

The immediate threat to Israeli scientific research, according to Oron in company with all his colleagues, lies in the drastic reduction in appropriations by the Israeli government. Like other scientists at the institutes of Applied Science of the Ben-Gurion University, Oron and Pasternak work long hours and with extraordinary dedication. Both complain of budget restrictions. "I have a research grant that allows me to [have] only one graduate student," says Pasternak. "There is no shortage of applicants, but I haven't time to work with more than one. I am not only a researcher but an administrator as well." Oron considers the slash in research funds as evidence of a lack of vision in the nation's leadership. He pointed out that he had no computer on his desk and was forced to share one with colleagues and with students. There were constant problems with the telephone. Time that could be spent on research had to be devoted to fundraising. "There is a lot of politics," says Oron, "in the competition for limited resources."

On the other hand, Oron comments (as do many of his colleagues, using almost identical language): "Under pressure you find solutions, sometimes solutions less expensive and more efficacious." Still, he insists, "You can't drive all the time with your gas pedal pressed to the floor." His unit has had to turn down research projects for lack of advanced equipment. "Not a tremendous sum is needed," he says, "but if you compare it to our salaries, it seems like a lot."•

Political Correctness Versus The Jews

E. B. Samuel

Words have consequences. George Orwell made this point a generation ago. When it comes to dealing with the ideas and goals which march under the banners of "political correctness" and "multiculturalism," Jews sense that they are confronting a very serious problem for a very simple reason. These battle cries, as currently formulated, make Jews incorrect par excellence.

Being politically incorrect is not necessarily identical to being scapegoated, dehumanized and finally physically destroyed as was done to European Jews during the 1930s and early '40s. But it does accelerate the marginalization of American Jews, a shrinking, assimilating minority in a growing population. And marginalization, problematic in itself, could be dangerous in a larger society that not only is diversifying but also, perhaps, fragmenting.

Today's slogans of political correctness and multiculturalism took root, as others have noted, in soil prepared by Marx and Lenin. Not all the Communist world generated by the ideas and words of Marx and Lenin has collapsed. Particularly benighted examples — North Korea, Cuba, Vietnam and China — remain, the latter two desperately seeking to survive by parasitically attaching Communist governments to partially capitalist economies.

Nevertheless, as communism crumbled from the Baltic states to Berkeley, the hard Left survived. True believers in need of a replacement creed, members of the post-liberal Left (the same people who idolized or whitewashed China, Cuba and North Vietnam in turn) found it in the multiculturalist perspective. This, in large measure, amounts to a reworking of Marx and Lenin's critique of the West as imperialist, oppressive, exploitative and, of course, racist.

Political correctness emerged in parallel. It serves as the rough approximation of Communist class consciousness. "Correct" groups of people — Blacks, women, homosexuals and so on — replace the proletariat as society's pillars, and "incorrect" groups — whites, men, heterosexuals, etc. — find themselves repackaged as the new kulaks, the class enemies, society's termites.

Western culture, it is repeated like agitprop at a party rally, is the source of all our troubles. Echoing Nazi graffiti about the Jews, it finds in the culture of "dead white males" the root of most evil.

Who are the deadest of white males — functionally even if not, perhaps, cosmetically? Not Jefferson and Madison, not Shakespeare and Milton, not even Aristotle and Plato, but Abraham and Moses. It was their teachings, today shorthanded as "Judeo-Christian ethics," which became the moral keystone of Western culture. And it is those teachings, those values, that are subverted by multiculturalism and political correctness.

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