

To Make a Desert Bloom: Seeking Sustainability for the Israeli Agricultural Adventure

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I. Introduction

Israel's emergence as an agricultural country was a matter of choice. Perhaps more than any other nation, it chose to pursue a romantic, ideological, agrarian vision. It was this dream of a rural, fertile homeland that drove economic policies, launched a sociological makeover, and produced astonishing changes in an ancient landscape and a people's self-image. This agrarian transformation has been manifested in breathtaking technological innovation, surprising triumphs in combating desertification as well as devastating environmental consequences.

Recently, questions about the very economic viability of Israeli agriculture have been raised. To answer them and understand the present choices that Israel faces as it explores what a "sustainable" future for agriculture" means, it is critical to understand the country's idiosyncratic heritage and its remarkable agricultural achievement.

The Jewish people of course were originally farmers. As embodied in the Bible's querulous ancestors Cain and Abel, pastoralism and agriculture provided the economic foundations for an Israelite society that could also support artisans, priests, kings and scholars. These agricultural origins are woven into the very rituals of the Jewish calendar – with religious holidays to this day celebrating first fruits, final harvests and the birthdays of trees. The numbing and prodigious minutiae of the Talmudic regulations and insights regarding agriculture in the Land of Israel, written over two thousand years ago, can compete for sheer detail with any of the encyclopedic manuals printed by the U.S. Soil Conservation Service or Extension Service.

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But this rural status changed as the Jewish people were forced into exile with the destruction of the Temple in 70 CE. As Jewish communities got used to minority status in their various Diasporas, different professional inclination emerged: peddlers, traders, money-lenders, physicians, and of course rabbis.¹ In some of the largest Jewish communities, this predilection was the result of intentional restriction. For example, by the Middle Ages, throughout Europe, Jews were prohibited from owning lands. By the 19th century both the world and the community itself had long since ceased to perceive Jews and farmers as synonymous – indeed the Jewish association with food production was as distant as any ethnic or national group in the world.

II. Antecedents of Israeli Agriculture

All this changed at the end of the 19th century, when Jews began to think about national renaissance in Palestine through a "Zionist movement". The simple impulse was to reclaim the Jewish national birthright as an indigenous people in their promised land. Farming was a critical part of the vision. The Socialist and dominant strain in the Zionist political movement used a metaphor of an "upside pyramid". It perceived labor patterns and professional affiliation as indicators for the warped state of Jewish affairs. Presumably, stable pyramids are to have a wide base of proletariat leading to a point of a professional class. In 19th century Europe, however, the occupational breakdown was such that the bottom of the workers' pyramid, a small minority of workers, were supporting far broader, less productive sections of the pyramid. This created an upside-down Jewish sociological pyramid, dominated by disproportionate numbers of white-collars, traders and scholars. The Zionist transformation was to flip this dynamic on its head and return Jewish society into a normal healthy pyramid, with a majority of farmers at its base.

¹ "The Diaspora", *The Jewish Encyclopedia*, <http://www.jewishencyclopedia.com>.

This Socialist impulse was strengthened by the enormous power of the Tolstoyan "ruralist" affection for "Mother Russia" and the great author's idealization of peasant culture. The ideas resonated among Jews of his time, who sought to apply this vision of agrarian harmony in their ancestral homeland.

Aaron David Gordon was not just an influential Zionist philosopher whose writing articulated this impulse, he also personified it. After working as a book keeper in Russia, he moved to Palestine in 1902 at age 47 and redefined himself as a farmer at the first Zionist kibbutz Degania, on the banks of the Sea of Galilee: He perceived agricultural labor as not only restoring an abandoned land, but also a damaged Jewish spirit. In his 1920 essay, *The Task Ahead* he wrote:

"We Jews have developed an attitude of looking down on physical labor.... But labor is the only force which binds man to the soil... it is the basic energy for the creation of national culture. This is what we do not have, but we are not aware of missing it... In my dream I come to the land. And it is barren and desolate and given over to strangers; destruction darkens its face and foreigners rule in corruption. And the land of my forefathers is distant and foreign to me and I too am distant and foreign to it. And the only link that ties my soul to her the only reminder that I am her son and she is my mother is that my soul is as desolate as hers."

The "back-to-the-earth" ethos adopted by the Zionists can be easily understood and is hardly remarkable in the general context of the era's Romantic philosophy that sought a purer alternative to the increasingly industrial, alienating, European, urban lifestyles. What is less comprehensible and more impressive in retrospect was the phenomenal success of this comparatively small cohort of Jewish agricultural pioneers who actually implemented this philosophical formula. With practically no training, they moved half way around the world, became farmers and lived up to their own axiom of "conquered the wilderness".

It was hardly a hospitable land for the would-be planters. Palestine at the turn of the twentieth century bore the scars of successive waves of conquests and occupations which had more regard for the military triumph than for the associated challenges of soil stewardship. Millennia of overgrazing, primitive subsistence farming practices and deforestation had

desertified a country whose modest precipitation leaves it almost entirely in a semi-arid/arid classification. The resulting erosion, land degradation, and general neglect are confirmed by aerial photographs from the period. Even without this degradation, the average organic component of soils in Israel is only 1.5% - literally half the 3% found in Europe.²

Mark Twain's famous travel log from the 19th century in *Innocents Abroad* offers probably as good a snapshot as any:

"Close to it was a stream and on its banks a great head of curious looking Syrian goats and sheep were gratefully eating gravel. I do not state this as a petrified fact - I only suppose they were eating gravel because there did not appear to be anything else for them to eat." His description of the Judean hills is a far cry from the lush landscape evoked by the Bible: *"There was hardly a tree or a shrub anywhere. Even the olive and the cactus, those fast friends of a worthless soil had almost deserted the country. No landscape exists that is more tiresome to the eye than that which bounds the approaches to Jerusalem."*³

Yet, the Jewish agricultural effort of the early 20th century confounded many non-Zionist, Jewish skeptics and proved the potential fecundity of the land of Israel. The Zionist movement was adept at fundraising and much of the funds raised were earmarked for agriculture. Though the real estate that Arab landlords were willing to sell was largely malaria infested swamps and wastelands, new agricultural settlements soon began to dot the map of Palestine. British land decrees limiting Jewish ownership slowed progress dramatically, but this 1940 table from the *Palestine Statistical Abstract* indicates the steady, almost geometric, increase in Jewish agricultural activity.

² Ami Ettinger, *Sustainable Agriculture in Israel – Greening the Desert or Greening the Environment?* Vol. 2, Israel World Watch Series, Tel Aviv Babel Publishers, p. 10-11.

³ Mark Twain, *The Innocents Abroad*, New York: Oxford Press, 1996 p. 555.

Year	# of Jewish Settlements	Inhabitants	Land Area
1899	22	5,000	300,000
1914	44	12,000	400,000
1930	107	45,000	1,050,000
1936	203	98,300	1,480,000
1939	252	137,000	1,650,000

While the Jewish farms supported livestock and a variety of vegetables and fruits, the crop of choice for the settlers was citrus. Between 1918 and 1938, Jews invested 70 million dollars in orange groves, and production grew seven-fold.⁴ Orange groves generated 80 percent of Palestine's export revenues⁵ and were the single greatest income generator, even though they only filled four percent of Palestine's eight million hectares of agriculture lands.⁶

The success was ostensibly due to another conscious choice by the Zionist farmers: they eschewed the existing agricultural methods and technologies of the local Palestinian peasant population – the fellahin. Theirs was to be a modern, Western agriculture. This dismissive attitude towards indigenous Arab population can be seen even in the brief quote by A.D. Gordon, who in fairness, was among the conciliatory Zionist leaders towards the Palestinian Arabs. The Zionist adage "*A land without a people for a people without land*" did not so much suggest that the Arab population was invisible, but that their national claims and culture were less worthy. Years later, Israel's founding first Prime Minister, David Ben Gurion, a genius at languages who spoke at least eight, refused to learn Arabic on the premise that Israel could only succeed as a European nation and that learning from the locals would be a strategic mistake.

And so, Zionism spawned a high input, "technological" agriculture. For instance, a key to the successful land reclamation by Jewish farmers was synthetic fertilizers. Fertilizer imports

⁴Baruch Kimmerling, Joel Migdal, *Palestinians, The Making of a People*, New York, Free Press, 1993, p. 329

⁵Baruch Kimmerling, Joel Migdal, *Palestinians, The Making of a People*, New York, Free Press, 1993, p. 329

⁶*The Soils of Palestine*, 1945, p. 162-63

jumped from 1,077 tons in 1922 to a peak of 14,698 in 1937⁷ Years later the nitrates would reappear as high concentrations in ground water in rural wells, but there was no way the zealous Jewish farmers in pre-World War II Palestine could have envisioned this sort of hydrological hazard.

Technical support for the Jewish national farming initiative was quick to follow. Agricultural research and extension stations were set up by the 1920s, largely bearing the philosophy of Professor Yizhak Volcani. Volcani's view held that the traditional agricultural methods in Palestine were unsustainable economically and he advocated mixed farm" with intense irrigation, European plows (later tractors) and diverse produce. Most of the agricultural activity in the Jewish sector was situated on private lands in Palestine before 1948, but with independence, the kibbutz and agriculture sector became dominant.⁸

The truth is that by the start of the twentieth century, the traditional Arab agriculture in Palestine was extremely meager for a variety of reasons. Operating in an essentially feudal context, with absentee landowners in Syria and Turkish tax collectors skimming away any possible profits, incentives (and yields) for Fellahin farmers were extremely low, even by Middle Eastern standards. Agricultural treks grew smaller and smaller as families subdivided shrinking land reserves. Production was meager. A 1937 study, for example showed a local Palestinian Arab cow providing 400-800 liters of milk a year (lactation) as opposed to a cow from Beirut Lebanon who could generate 2000-3000 kg or from Damascus who could reach 3,500 kg.⁹ (For purposes of comparison, in 2003 Israeli cows on kibbutzim were providing an average of 8,529 kg/lactation, the highest national rate in the world.)¹⁰

While the British Mandate government attempted modest assistance to the Arab agricultural system, through subsidized olive trees and technical assistance, these efforts were more symbolic than anything else. With no capital to support any upgrading of infrastructure, a largely illiterate farming population without extension support and the relentless competition

⁷Table 87 in *The Soils of Palestine*, 1945, p. 164.

⁸ Moshe Schwartz, personal communication, August 4, 2005.

⁹ Aaron Boneh, *Land of Israel and its Economics*, Tel Aviv, Dvir Publishers, 1938, p. 81.

¹⁰ Israeli dairy survey, (in Hebrew) 2003 at <http://www.icba.org.il/mazagot-month/seker-refet-hachalav-30-11.pps>

of an extremely ambitious and increasingly prosperous Jewish sector, indigenous Palestinian Arab farming began to fade. By the end of the British colonial period, some 64% of local Arabs theoretically lived off the land, but an increasingly large percentage found work with the Jewish economy or were simply destitute.¹¹

There is some debate as to the environmental integrity of the Jewish settlers' agriculture work. Although the prevailing paradigm was a heavily mechanized, monoculture – it was largely pesticide free and soil conservation was an integral part of the program. With soil conservation as a basic indicator of sustainability and stewardship, in retrospect we can enjoy the testimony provided by one objective outsider. Walter Clay Lowdermilk, a world renowned soil scientist, was sent by the USDA just before World War II to conduct a survey about the state of soils in the ancient Levant. His report from Egypt, Tunisia, Algeria and Morocco was bleak indeed:

*"We visited sites of special interest for a soil conservationist and almost everywhere we saw repugnant evidences of deadly soil erosion, superseding the results of skilled land use during previous centuries."*¹²

His assessment of the ecological impacts of the indigenous Felah agriculture was similarly grim:

*"Here before our eyes the remarkable red earth soil of Palestine was being ripped from the slopes and swept into the blue of the Mediterranean to a dirty brown as far as the eye could see. We could well understand how many centuries this type of erosion had wasted the neglected lands. It is estimated that over three feet of soil has been swept from the uplands of Palestine after the breakdown of terrace agriculture."*¹³

In contrast, he saw the soil conservation efforts of the Zionist farmers, who at the time controlled only 6% of the lands, as sensational:

"We were astonished to find about three hundred colonies defying great hardships and applying the principles of co-operation and soil conservation to the old Land of Israel..... here in one corner of the vast Near East though, work is in progress to rebuild the fertility of

¹¹ *The Soils of Palestine, op. cit.* 1945, p. 157.

¹² Walter Clay Lowdermilk, *Palestine - Land of Promise*, New York: Harper and Brothers, 1944 p.3.

¹³ Walter Clay Lowdermilk, *Palestine - Land of Promise*, New York: Harper and Brothers, 1944 p. 5

*land instead of condemning it by neglect to further destruction and decay... The country is emerging from a backward low-yield agricultural economy, dependent chiefly on grains and olives and is evolving towards a modern, scientifically directed and richly diversified economy with fruits, vegetables, poultry and dairy products play an ever greater role. The wooden plow is yielding to the tractor, the flail to the threshing machine. Rural Palestine is becoming less and less like Trans-Jordan, Syria and Iraq and more like Denmark, Holland and parts of the United States."*¹⁴

III. Israeli Agricultural: From Miracle to Malaise

Once Israel was established in 1948 and the Zionist settlement agencies were freed of the constraints of British land and water proscriptions, the new Jewish State set out on a sizzling dash to expand agricultural production. In five years, during the 1950s, cultivated lands increased by 150% -- with the percentage increase of irrigated plots even higher. The National Planning and Building Law was rigged so that the default zoning for open spaces was for "agricultural usage".¹⁵ Changing the classification of farmlands required approval of a committee dominated by agricultural interests.¹⁶ During this period, agricultural settlement actually doubled, with the number of Jewish farming communities increasing from 300 to 600.¹⁷ Areas that had been written off for millennia as desert reemerged as arable lands, as the ideological fervor that characterized the pioneer spirit was given a state-supported framework that both deified and subsidized agriculture. Figure 1 shows the continuous expansion of agricultural production in Israel since the founding of the state.

¹⁴Walter Clay Lowdermilk, *Palestine - Land of Promise*, New York: Harper and Brothers, 1944 p. 6.

¹⁵ The Planning and Building Law, 1965, *Sefer HaChokim*, 1965, p. 307.

¹⁶ Eran Feitelson, "Protection of Open Spaces in Israel at a Turning Point," *Horizons in Geography*, vol. 42-43, 1995, p. 9-13. See in particular the 1968 amendments to the Law and the creation of the Agricultural Lands Preservation Committee.

¹⁷ Ayal Kimhi, "The Rise and Fall of Israeli Agriculture: Technology, Markets and Policy", *Paper presented at Sung Kyun Kwan University*, October 2004.

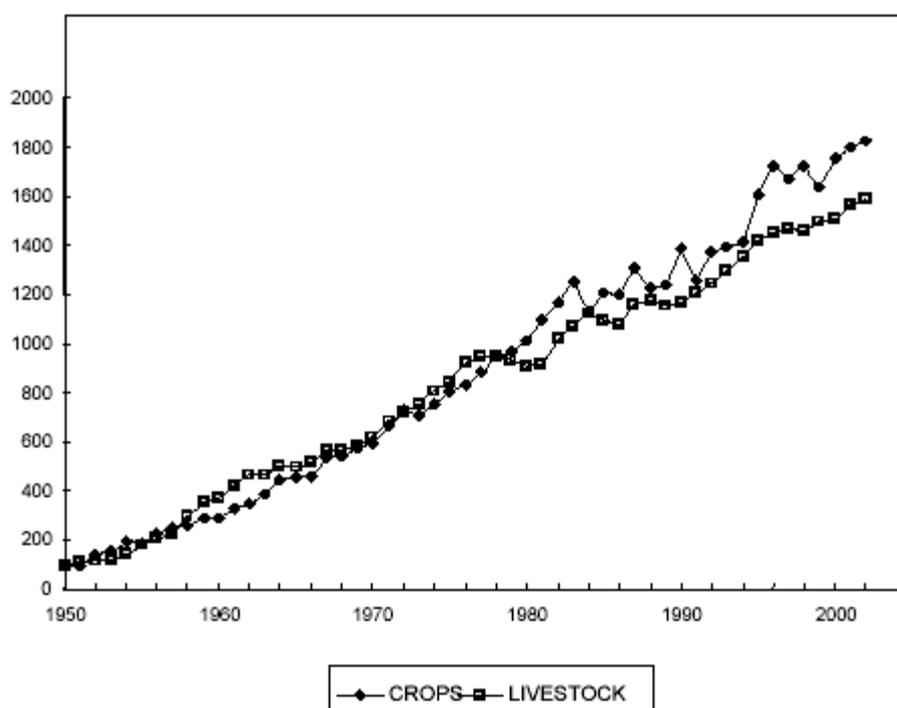


Figure 1: Quality Index of Agricultural Production, Crops and Livestock

Source: Source: Ayal Kimhi, 2004

The steady growth in yields has managed to continue to the present, even as the trends in new land development leveled off. Table 1 indicates that roughly a quarter of land in Israel is being utilized for agriculture production and this rate is fairly steady. This proportion is extremely high considering that most of the country is arid or semi-arid in its precipitation levels.

	<i>Thousands of Hectares</i>	<i>% of total lands</i>
Total area of Israel	2,245,000	100.0
Built Areas	200,000	8.9
Non-agricultural open spaces	1,146,000	51.0
Nature Reserves and Forests	347,000	15.5
Pasture	141,000	6.3
Arable lands	411,000	18.3

Table 1: Land Use in Israel

Source: Ministry of Agriculture, 2001

As to the composition of Israeli agriculture, Table 2 provides a general breakdown of present production according to land use. As would be expected given the climatic conditions, the majority of agricultural lands are irrigated. Roughly a quarter of agricultural lands are

dedicated to orchards, with citrus still comprising a major component of local fruits, even as the groves have migrated south to the northern Negev. Flowers and ornamental plants, intensely raised in greenhouses, provide revenues far greater than their 1.6% of land space. In general some 1456 hectares of land are utilized as green or "hot" houses.

	<i>Thousands of Hectares</i>	<i>% of total lands</i>
Total	382.2	100
- Irrigated crops	192.3	58.6
- Rain supported crops	136.9	41.4
Orchards	84.8	25.8
- Citrus	25.3	7.7
Vegetables, potatoes, melons,	55.1	16.8
Flowers, and ornamental plants	5.2	1.6
Field Crops	183	55.8
I - cotton	29	8.8
- wheat	86	26.2

Table 2: Agricultural Use of Land in Israel

Source: Ministry of Agriculture, 2001

It is worth mentioning a word or two about the agricultural fate of the 150,000 Arabs who remained in Israel after the War of Independence. Most Palestinian Arabs fled the country during the fighting for a variety of reasons. The new Jewish government for obvious reasons was not interested in rebuilding the Fellahin communities who had frequently been hostile and reestablishing Arab control over State lands. In many cases, farmers were not allowed to return to their homes. Under the 1950 Absentee Property Act they were paid compensation that fell far short of the land's actual value.

About forty percent of private-Arab land resources were confiscated during this period and today Arabs, who are 20% of the population, own only 3.4% of the lands.¹⁸ This shift in land ownership was certainly not an objective of the young State as it set about defending itself from the attacks of five Arab armies and the local Palestinian Arab militias, but it was an undeniable outcome. With the loss of most of their lands, the already beleaguered "fellah" economy went into free fall. Already, it could not really compete with the highly

¹⁸ Alon Tal, *Pollution in a Promised Land, an Environmental History of Israel*, Berkeley, the University of California Press, 2002, p. 330.

mechanized Jewish agricultural sector. By the 1990s, only 8 percent of Arab-Israelis made a living in agriculture.¹⁹

In their excellent book: *Palestinians- the Making of a People*, Kimmerling and Migdal summarize the process:

*"Even where they held onto their plots, the Arabs found it difficult to stay in farming. The state severely limited their water and electricity quotas, particularly when compared to the more productive neighboring Jewish communal and cooperative farms. And the Arabs found themselves excluded from the country's powerful marketing, credit and purchasing cooperatives. Arab-owned citrus groves all but disappeared; in the 1950s the fellaheen fell back on subsistence production with supplemental marketing of olive oil. It is thus not surprising that many Israeli Arabs abandoned agriculture altogether. In Zureik's terms, they underwent a process of depeasantification. The land became the domain of those with the machinery to exploit. By the 1960s and 1970s, Arab agriculture in Israel would undergo significant mechanization and cash cropping, Israeli research organizations speaking of a shift from fellah to farmer."*²⁰

But at the national level, agricultural production grew geometrically. When broken down to its constituent parts, the phenomenal success of Israeli agriculture during the past 57 years can be attributed to seven factors:

- a) A Commitment to Food Security;
- b) Extraordinary Water Development;
- c) Innovative Technological Development;
- d) Steady Increase in Available Work Force;
- e) A Unity of Purpose in Israel's Agricultural Settlement Movements;
- f) Unconditional Political/Economic Support; and
- g) The Growing Availability of Export Markets.

¹⁹Magad el Haj, "The Arab Village in Israel, General Lines," *Solutions for Disposal, Treatment and Reuse of Wastes in Rural Areas of Israel*, in *Symposium Proceedings*, Khatam K'naneh Ed., Rama, The Galilee Society, 1988, p. 8.

²⁰Baruch Kimmerling, Joel S. Migdal, *Palestinians, The Making of a People*, New York, The Free Press, 1993, p. 161.

Yet many of the very factors that created such agricultural prosperity have changed – from agriculture's perspective, not for the better. Indeed, there is a wide perception among Israelis that agriculture in Israel has lost its luster, comparative advantage and most importantly, its future. While agriculture provided 30% of national GNP during the 1950s²¹, today's 3.2 billion dollars in annual production is only 1.6% of GDP. The trends for each of the above factors raise serious questions about the sustainability of Israel's present agricultural economy. A few words about each, therefore is in order.

A. Food Security

Israel's initial years were characterized by chronic shortages of food. As the nascent State of Israel was absorbing hundreds of thousands of refugees from Arab lands, it faced a boycott from its Moslem neighbors. Domestic food production was inadequate and proteins in particular were in short supply. Strict rationing of basic food supplies by the central government spawned a black market for a variety of food staples.²² This period of collective hardship, known locally as the "Tsenah", left an imprint on the national psyche.

As agricultural researcher Dr. Elaine Solowey recalls: *"On Kibbutz Matsuva during the fifties, the choice for a protein course during a meal was between ten olives and one egg. This memory drives the feeling that Israel needs its own milk, eggs etc. Rationing was very strict and many kibbutzim, like Scarlet O'Hara, declared they were never going to be hungry again and started up an amazing variety of projects from raising guinea fowl to growing mushrooms."*²³ While today, Israeli supermarkets offer a cornucopia of domestic and imported products that is as plentiful as any in the world, the residual trauma left a commitment that for fifty years has supported agricultural self-reliance. Recently, however, many Israelis have grown more confident about the country's long term ability to import food, notwithstanding its tenuous international stature in much of the world.

B. The Water Balance

²¹ Daniel Hillel, "Irrigated Agriculture," *The Negev, Land, Water and Life in a Desert Environment*, New York, Praeger, 1982, p. 39.

²² Tom Segev, *1949, The First Israelis*, New York, The Free Press, 1986.

²³ Dr. Elaine Solowey, personal communication, July 25, 2005.

In anything beyond a subsistence economy, agriculture in semi-arid and arid climates cannot rely on rainfall as its water source. The impressive achievements in agricultural production reached prior to the Israel's independence were made possible due to a coordinated water development program in the Jewish sector. It was coordinated by Mekorot, a public company that essentially became the national water utility when the state was created. Israel's founding political Socialist leaders, almost all of whom came from the agricultural sector, perceived water as the engine that would fuel the incipient nation's rural economic development. During Israel's first decade, some 80% of infrastructure investment went into water works and carriers. Fifteen years after the War of Independence ended, the country had put in place a massive system for redistributing the naturally asymmetrical hydrological allocation.

Despite the protestation of its Arab neighbors, Israel's National Water Carrier to this day takes water from the relatively rainy Galilee and the Kinneret Lake (Sea of Galilee) in the north and carries it down through a grid to irrigate semi-arid plots to the center of the country and the southern Negev desert. It was "hydrological socialism" and the results did not disappoint. Then, as during most of Israel's history, water was highly subsidized. With incentives to open all the new spigots in place, for Israel's first thirty years, agricultural production could burgeon geometrically.

Of course there were significant environmental ramifications to this aggressive water exploitation policy. The relatively saline waters of the Kinneret exacerbated groundwater contamination when they were used for irrigation and salinized the soil. Water resources had already begun to deteriorate due to overpumping of the country's largest aquifer that was mined to support new agricultural settlements along the coast. The results were quickly manifested in sea water intrusion and increased salinity levels. By the 1950s, wells were closed. A decade later, when Israel found yet another new source for irrigation, recycling a substantial percentage of its sewage, an additional stream of contamination was added.

With regard to wastewater reuse, it is worth taking a minute to consider the Israeli experience, which is unique and instructive. Israel was the first country on earth to make effluent recycling a central component of its water management strategy, setting standards for reuse and designing a national blueprint. When the original masterplan was framed in 1956,

it originally envisioned the ultimate recycling of 150 million cubic meters – all going to agriculture. Today three times that level is recycled -- a total of over 60% of sewage. Effluents today contribute roughly a fifth of Israel's supply, and a far higher percentage of the irrigation supply for agriculture.

But there has been considerable concern about the adequacy of the standards for reuse in irrigation, given the poor pretreatment among many industries, inadequate oversight and the leniency of the standards. Thus, while Israeli agricultural water policy and irrigation resourcefulness has facilitated increased production and expanded water resources, there has been an indisputable ecological downside. This legacy includes high nitrate concentrations in aquifers, periodic bacterial episodes in urban drinking water sources and a steady increase in the levels of salt in aquifers, making dozens of wells unfit even for agricultural utilization.

C. The Benefits and Costs of Hi-Tech Agriculture

When Israelis were surveyed, looking back after fifty years of statehood about country's contribution to the world's technology, they voted "drip irrigation" to be the country's most important invention. It even came ahead of the legendary epi-lady hair removal system and ICQ software. Developed by the kibbutz-based Netafim corporation, drip irrigation has created a world-wide revolution in farming for water scarce regions – but not only: for example, the Florida citrus industry and the Northern California marijuana growers have come to understand the benefits of bringing water in precise quantities, with optimal fertilizer concentrations directly to the root zones of plants and they have embraced the technology. Health hazards of drift from waste water irrigation are also prevented by the systems and bacteria are neutralized on route. Computers run the entire operation.

In Israel drip irrigation is ubiquitous and it is the primary reason why water delivery efficiency has increased from 64% to 90% since the 1960s - with the amount of water per hectare dropping 50% - from 8,700 to 5,500 as yields continued to skyrocket. It makes great sense economically, if you have the capital to pay for it. There are other aspects of Israeli agriculture that make it a "high input" affair. Pesticide usage is widespread and when chemicals are replaced with clever biological substitutes developed in Israel – application often requires even greater sophistication and training. Especially in Israel's sandy arid

regions, soils essentially serve as "flower pots"²⁴ with farmers providing the nutrients through costly organic and inorganic fertilizers.

In short, Israeli agriculture has grown more technologically sophisticated. This has been a key to the successive increase in yields. But it also means that it has become more expensive to become a successful Israeli farmer. The upfront inputs cost money, and the demands of human capital and associated expertise required to successfully compete has also increased. This serves to make the entire agricultural sector more vulnerable. The environmental balance sheet may be mixed, but on the whole, Israel's embrace of technological innovation has meant more efficient water and fertilizer utilization and recently, a drop in pesticide consumption.

D. The Shrinking Labor Market

Israel's population has grown geometrically due to massive immigration and to a lesser extent, a relatively high birthrate. When the dust settled after the War of Independence, there were hardly a million citizens. Today there are over six million. This clearly created an employment challenge. During the 1950s, agriculture provided jobs for hundreds of thousands of immigrants as well as indirect employment in related services. Agricultural jobs paid reasonably well and were part of the pioneering fervor that accompanied the creation of a Third Jewish Commonwealth. But the appeal began to change by the late-1970s and '80s.

Several reasons were responsible for this. Technology and mechanization supplanted many labor intensive practices. As the society became more affluent, agricultural wages for laborers were relatively meager. And then the bosses themselves started to lose interest.

To keep up agronomically meant massive investment of income in the latest tractors and technologies. Agricultural operations, whose justification had initially been largely ideological or political, found that they could not make ends meet.²⁵ Small farms began to opt out. Agriculture, as a livelihood was perceived as less prestigious and was empirically less lucrative relative to other professions. The number of family farms dramatically

²⁴Jared Diamond, *Collapse*, New York, Viking Press, 2005 p. 381.

²⁵ Moshe Schwartz, *Unlimited Guarantees: History, Political Economy and the Crisis of Cooperative Agriculture in Israel*, Ben Gurion University of the Negev Press, Beer Sheva, 1995,

decreased with scores of small operations defaulting on loans that triple-digit inflation of the 1980s "inflated" to extraordinary levels, and simply sought alternative employment.²⁶ Government records show that between 1981 and 1995, the number of farms in Israel plummeted: from 43,450 to 25,900.

By 1999, 70% of the 80,000 people who worked in farming (3.3% of the labor force) were hired laborers.²⁷ This surely did not help the troubling pathology of double-digit unemployment in Israel that resulted from the "intifadah" and associated political turbulence after 2000. In many areas, the foreign Thai farm workers vastly outnumber the host land owners. These migrants joined Israel's workforce, when their predecessors, Palestinian day laborers were perceived as a security threat or simply grew unreliable due to mounting political tensions and violence. In short, by most estimates, today, only some 20% of Israelis living in rural areas actually work as farmers.²⁸

Figure 2 shows the steady slide in the number of Israeli agricultural workers. The graph actually understates the phenomenon as it relates to the total *number* of workers. Inasmuch as Israel's population has increased 6-fold over the past 57 years, the drop in the *percentage* of the workforce engaged in agriculture is far more dramatic.

²⁶ Yoav Kislev, s "Experience with Collective Action and Cooperation in Agriculture in Israel." In *Agricultural Cooperatives in Transition*, Eds. Csaba Csaki and Yoav Kislev, Boulder, Colorado: Westview Press, 1993, p. 269-290.

²⁷ Arie Sheshkin and Arie Regev, *Israel Agriculture, Facts and Figures*, Ministry of Agriculture, December, 2001, p.3.

²⁸ Chaim Oron, past Minister of Environment, personal interview, July 24, 2005.

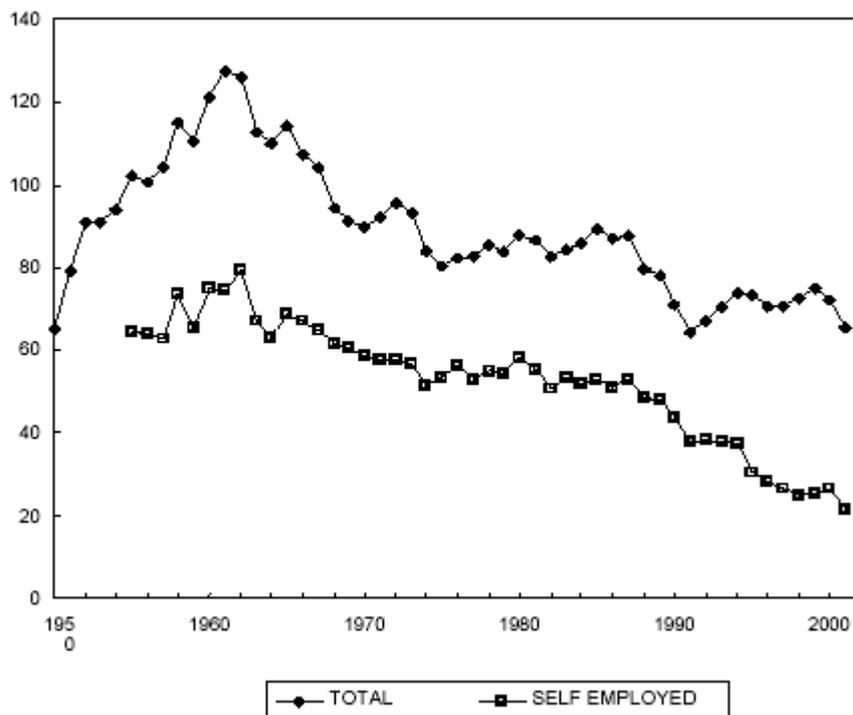


Figure 2: Thousands of Workers in Agriculture; self-employed and total

Source: Ayal Kimhi, 2004

E. The Lost Ideological Unity of the Agricultural Collectives

Israel is the home to a variety of different "ways of life" in its rural sector, most notably "kibbutzim" or collective intentional communities and "Moshavim", rural villages with a modest cooperative base. From their inception, these communities were highly motivated as "front line soldiers" in many of Israel's national challenges: immigrant absorption, creation of geopolitical facts on dangerous borders and of course improving food security.

But today, Israel's rural sociology has become a very different mosaic. Many kibbutzim have parted ways with the Marxist utopian aspirations of their founders. Members receive differentiated salaries and the level of shared commitment has given way to a preference for privacy and the profit motive. They have become quaint, but capitalist rural villages. Many "moshavim" – have turned into little suburbs, with fields turned into condos and members preferring to join the general labor force. Even the many kibbutzim who have chosen to retain their collectivist ethos do not automatically embrace national challenges with the alacrity that they once did. The less than charitable market conditions and the material aspirations of their members make them more circumspect.

There are also economic forces at work. There is no denying that the general trend agronomically is in the direction of economies of scale. To be competitive, farms have had to grow bigger. A major initiative by the Ministry of Agriculture during the 1990s both upgraded the environmental regulations for dairies, and encouraged mergers to improve efficiency. Over a billion dollars were provided in government grants to ease the transition,²⁹ but the modernized results essentially squeezed out dozens of small, family, milking operations. Once a 1.2 hectare greenhouse was considered enormous, and now four hectares is the standard.³⁰

In this sense, Israel is not disconnected from the world dynamics of agriculture which in most countries appear to be more conducive to larger than smaller operations. One could argue that there is a greater justification to subsidize small producers, as they often get more yields on the average with less waste and have the potential to produce less environmental disruption than bigger operations.³¹ Yet not just capital investment but regulatory red-tape and price supports often favor the agribusiness man over the family farmer. Figure 2 confirms the magnitude of the transition in Israel with small family farms in the moshav villages giving way to larger agri-businesses.

²⁹ Shalom Simhon, past Minister of Agriculture, presentation, Vered Ha Galil, February 10, 2005.

³⁰ Oron, *op. cit.*

³¹ Elaine Solowey, *op. cit.*

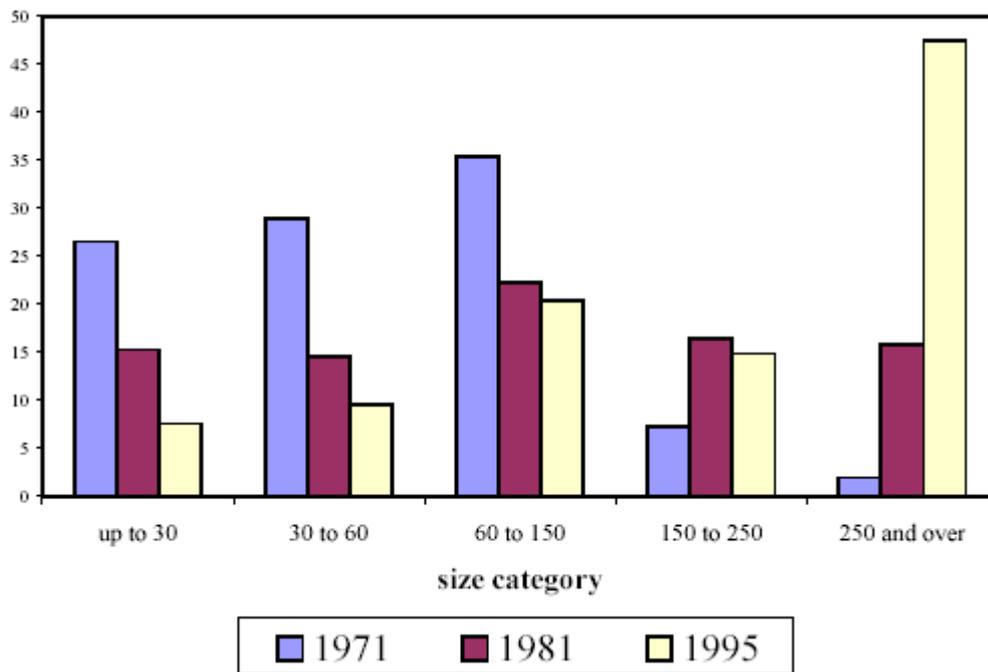


Figure 2: Size Distribution (in dunams) of Active Farms among Israeli Moshavim

Source: Ayal Kimhi, 2004

Profits, rather than ideology and lifestyle, are at the heart of agri-business decisions. It is likely that the increased economies of scale will be good for the food and fiber industry. The increase in the size of Israeli farm probably bodes well for the environment as well, as large farms have been shown to have greater resources and ability to adopt environmentally friendly practices.³² Whether this trend is healthy for the social fabric of rural Israeli society, is another matter entirely.

F. Political/Economic Support

There has always been an agricultural lobby in Israel whose influence was far greater than its actual numbers of the population.³³ Its strength has never rested on its diminishing electoral power, but rather on the deeply embedded, ruralistic impulse that resides in decision makers, regardless of their political affiliation. Israelis identify with the verdant landscape of the

³² Alon Tal (Rosenthal), "State Agricultural Pollution Regulation, A Quantitative Assessment," *Water Environment and Technology*, Vol. 2, No. 8, 1990 p. 50-58.

³³ Alon Tal, *Pollution in a Promised Land, an Environmental History of Israel*, Berkeley California, University of California Press, 2002, p. 200.

countryside, and see something wholesome in its preservation. Moreover, in a nation still besieged by belligerent Arab nations who have successfully initiated boycotts against Israel in the past, food security is not just a slogan but a real concern.

From the first day of independence, this political support was translated into money. Water was subsidized. Price supports were offered for many basic crops. Disaster relief was provided. A highly professional army of extension agents were made available. Research was funded generously. For example, on average, the Ministry of Agriculture in Israel currently invests some 70 million dollars a year in agricultural research³⁴; by way of comparison, the Ministry of Environment's annual research budget averages less than two million dollars.

The past few decades, however, have seen a softening of this support. Water prices have gradually increased and if present trends continue, there will soon be no difference between domestic and agricultural prices in Israel. The status of the once vaulted kibbutzim has suffered from many decades of rule by right-wing parties who harbor few nostalgic sentiments towards the epi-center of their political nemesis. Indeed, since the Likud party was elected into power in 1977, not only was the sector denied the preferential economic treatment it enjoyed during the country's first thirty-years, it had to deal with a disinformation campaign, frequently supported by politicians who were happy to caricature the entire sector as "freeloading" parasites. The Jewish Agency, a Zionist development agency funded by Jewish donors from around the world, bankrolled hundreds of settlements for almost a century, only to discontinue its institutional support for agriculture and new agricultural settlements during the 1990s.

Where previous policies made it practically impossible to "sell-off" agricultural lands, new flexible policies have allowed many farmers to change the zoning of their lands, or simply illegally rent them to sundry commercial ventures, producing powerful incentives to cease farming. As a result, Israel's agricultural community is sometimes branded as "land speculators", with enough examples of abuse to provide justification for Supreme Court

³⁴ Israel Ministry of Agriculture web site, www.moag.gov.il

intervention to stymie the dynamic. In short, Israel's agricultural community finds itself "on its own" as never before.

G. Export Markets

By 1960, although its population had doubled twice in twelve years of statehood, Israel had already become self-sufficient in food production. And still the yields continued to grow. Export markets provided a continuously steep demand curve, even relative to the general economic growth. During the 1950s, some half of Israel's total exports was agricultural products, but this dropped precipitously to 5% by 1966.³⁵ Israeli flowers, fruits and vegetables continue to do very well in the European market place and niche products, such as dates and on occasion even winter onions brought in considerable foreign currency.

The trouble is that this dependency on foreign markets made the capital intensive Israeli farmer vulnerable to price fluctuations. Until the 1980s, Israeli agriculture was among the most subsidized in the world, with the full value of support exceeding the 80% European subsidy levels. But that decade saw a dramatic change in public policy. With the drop in government subsidies, the relative profitability of Israeli produce tumbled, and farm operations often had difficulty competing with fruits and vegetables grown in countries where day-laborers took home a dollar a day, or where government subsidies were enormous.

Figure 4 shows the tendency of world prices to fluctuate. Even more importantly, it reflects the huge drop in prices on the world market for Israeli agricultural products, far greater than that in the domestic Israeli market. With free trade agreements fueling Israel's economy overall, the new, unfettered competition with subsidized European produce has put some parts of Israeli agriculture at a distinct disadvantage. Some economist claim that there is no reason why Israel shouldn't benefit from the irrational policies behind the inexpensive French pears or apples that can be found in Israeli stores. But a price is definitely paid by Israeli farmers.

³⁵ Kimhi, *op. cit.*

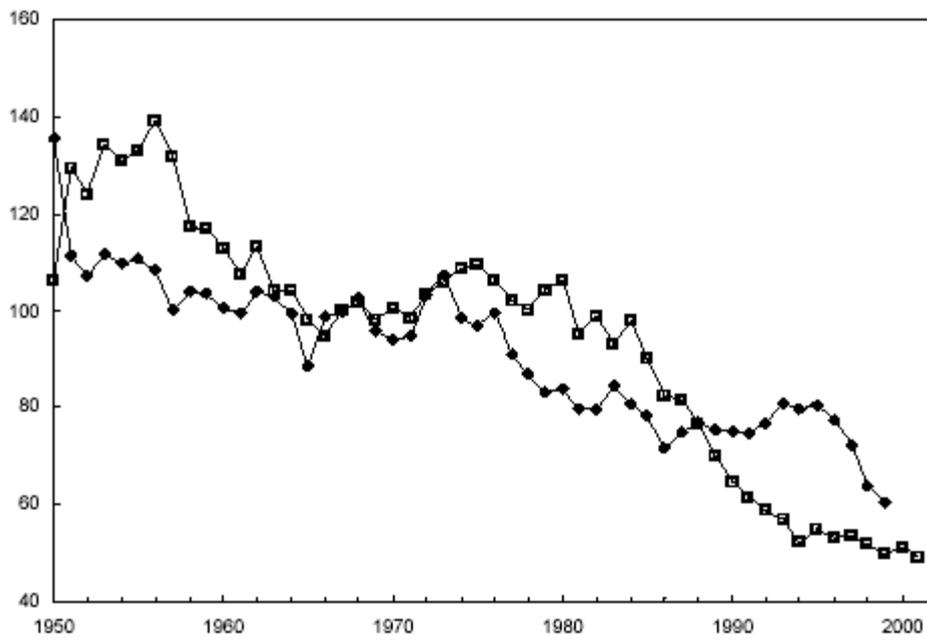


Figure 4: Price Index of Agricultural Products – Israel and the World

Source: Ayal Kimhi, 2004

IV. Towards Sustainability

Today, Israel's agriculture is at a crossroads. Once again, choices must be made. In considering the many issues surrounding agriculture's future, it is important that environmental factors be considered in the economic equation. Fundamental societal values or assumptions within the farming sector have already begun to change as local agriculture seeks to survive in a world with new economic and environmental demands.

For many years, farmers and agricultural policy were considered ecological enemies by the Israel's environmental movement: Farmers' profligate use of water and the Israel Water Commissioners pro-agriculture allocation priorities left many nature reserves high and dry. Pesticides left drinking water and a range of fresh produce unhealthy. Fertilizers spawned eutrophication in surface waters and the resulting nitrate concentrations led to the closing of dozens of drinking water wells. Streams stunk with the excrement of discharged livestock wastes. The plastics associated with high-input winter cultivation created a solid-waste disaster. When they were mixed into the bonfires that frequently disposed of crop residues, it created a serious air pollution hazard. Most of these environmental complaints were well-grounded.

Yet, as Israel's environmentalists began to prioritize their environmental challenges, the country's dwindling open spaces began to top everyone's list. The irreversible nature of sprawl, the retreat in the astonishingly rich local biodiversity, and the sense of loss at a landscape that had for so long inspired pilgrims and prophets – all these led to a sense of crisis. Objective analysis led to the conclusion that the past agrarian policies that had protected Israel's landscape with great success had used agriculture as a centerpiece.³⁶ But the protection of farmland was weakening.

Suddenly, farmers didn't look so bad after all. Even from an aesthetic point of view, there was a new sense of appreciation. To be sure, nature reserves have an enormous power and appeal. Yet, some 25% of Israel's land is already set aside for biodiversity preservation and

³⁶ Ephraim Shlain and Eran Feitelson, *The Formation, Institutionalization and Decline of Farmland Protection Policies in Israel*, Jerusalem, Floersheimer Institute, 1996, p. 10-11.

hiking. It was the farmlands that were threatened with extinction. And Israelis realized how much they had come to appreciate this verdant heart of their local landscape.

When Hebrew University economists Aliza Fleischer and Yaakov Tsur took a look at how the agricultural landscape affected the travel decisions of Israeli tourists, they found that there was an enormous "willingness to pay" to travel to and through a cultivated countryside. The results of their research suggest that the economic return (crop sales) on agricultural land is only 16% of its actual value, given the Israeli penchant for rural vistas.³⁷ The rose-colored tinted vision of bucolic Israeli landscapes is largely color blind. Both Arab and Jewish agricultural lands are viewed with the same sentimental and perhaps wistful fondness.

What we have here in short is an "externality". Externalities typically connote a negative result from an economic activity that is thrust on an unsuspecting and unenthusiastic public. But externalities can also be good. In this case, Israel's beleaguered farming community is producing a landscape, valued at millions of dollars, for public enjoyment. Yet it receives no return on the product, because it is essentially a public good. In this context, subsidies make sense economically. Moreover, as many European nations have stressed, agricultural lands serve as real estate reserves, preserving options for future generations.

Israel's agricultural community had also taken a greener path. Spurred to a large extent by European pesticide residue standards, chemical usage began to drop during the 1990s. The Ministry of Agriculture actively promoted Integrated Pest Management, using a variety of pheromones, natural predators and biological materials to control unwanted bugs and weeds. The waste treatment systems installed in many Israeli feedlots and dairies more than equaled the sewage plants installed to treat human residuals. Some kibbutzim even managed to recycle their plastics and make mulch out of their organic loadings.

This is not to say that Israeli agriculture is not without its ecological critics. In a paper published by the local chapter of World Watch Israel, Ami Ettinger subjects Israeli agriculture to a strict ecological critique. As the introduction summarizes:

³⁷ Aliza Fleischer, Yaakov Tsur, "Measuring the Recreational Value of Agricultural Landscape" *European Review of Agricultural Economics*, Vol. 27, No. 3, September 2000.

*"In Ettinger's eyes, Israeli agriculture, similar to that of the world's, is not sustainable, and contributes significantly to the growing environmental crisis on our planet. Ettinger's point of departure is the urgent and unavoidable need to change direction in order to stop the deterioration in ecological systems on which humans are dependent for existence. Ettinger strongly criticizes modern agriculture as ignoring this dependency on natural systems and thus damaging them. In so doing it damages itself. In his view, the origin of the problem is in the modern uni-directional agricultural perspective instead of a cyclical one. Rather than using a cycle of plantings, modern agriculture is based on monocultures. Rather than conserving the fertility of the soil from year to year, there is a perpetual need to fertilize. Rather than using eco-agricultural systems, that encourage solving pest problems through natural enemies, modern agriculture uses chemicals excessively until they wipe out entire ecological systems along with the natural enemies of the pests."*³⁸

These high ecological standards should be set in the context of an increasingly tough world market. Israel has been experimenting with organic agriculture since 1943³⁹ and since 1982 is home to a moderately active *Union of Organic Growers*. But organic produce has not caught on. Despite several efforts to be competitive, Israeli organic products are still considerably more expensive or alternatively, less productive. For example, the highly successful date orchard at Kibbutz Samar converted to become organic during the 1990s, and finds its yields to be roughly two-third of its neighboring settlements, which actually use extremely modest chemicals.

Israel's population has grown and it is unlikely that it will ever return to full food self-sufficiency. The organic ideal has an important place in any agricultural community and should be a constant presence as a source of inspiration and an object of aspiration. With present practices consistently moving in an ecologically sensitive direction, it seems unfair, however, to brand conventional agriculture as downright unsustainable. Enforcing existing pesticide residue standards and the Israel Water Law's prohibition on causing any form of pollution could provide sufficient incentive to continue the trend of reduced reliance on

³⁸ Eilon Schwartz, "Introduction" in Anders Ami Ettinger, *Sustainable Agriculture in Israel – Greening the Desert or Greening the Environment?* Vol. 2, Israel World Watch Series, Tel Aviv Babel Publishers, p. 6.

³⁹"Field Crops" *Agricultural Encyclopedia* (in Hebrew), vol. 5, Tel Aviv, 1989 p. 192.

chemicals. And more effective public education about the health benefits of chemical free produce might boost consumer demand sufficiently to make organic alternatives competitive.

There are some "water experts" who argue that the way to solve the region's water scarcity problem is through the phase out of agriculture. "Virtual water" – the importing of water intensive crops, is favored over continued cultivation.⁴⁰ Yet, even proponents of "virtual water" – who would solve local shortages through increased importation of water intensive crops, would agree that Israel will always need to produce its own eggs and milk. The present 85% local production is an impressive achievement when you add to it the enormous quantities of produce grown for export.⁴¹ This accomplishment has even greater meaning given the land and climatic conditions in which much food production takes place.

Israeli innovations in developing salt and drought resistant strains of fruits and vegetables, through the creative and patient combinations of germplasm has produced new crops with the potential to eliminate famine in drylands.⁴² Here, one can argue, that Israeli agriculture is making a commendable contribution internationally. Perhaps, in an ideal world, the greater land reserves available in neighboring Arab countries could provide much of the food and fiber consumed locally. But, at present, this appears even more of a dream than a prosperous organic agricultural sector.

With the very future of the agricultural sector wavering in the balance, it is time that Israeli society makes choice once again. It needs to make an enduring commitment to its rural sector. Subsidies can take many forms. To be fair, present subsidies of Israeli water are trivial compared to the past, and far below that found in other Western nations. Moreover, it is not inconceivable that for a variety of produce and flowers, water will no longer constitute a constraining factor. New breakthroughs in membrane technologies have reduced the price at

⁴⁰ *Rudolf Orthofer, Ra'ed Daoud, Jad Isaac Hillel Shuval*.-Options For A More Sustainable Water Management In the Lower Jordan Valley" *Water ForLife Conference*, Anatalya, Turkey, October 10-14, 2004.

⁴¹ Web site of the Negev Foundation, "Need for Desert Agriculture", <http://www.negev.org/About/need.htm>, August, 2005.

⁴² Arava Institute for Environmental Studies, web-site: "Desert Agriculture, The Introduction of New Crops to Arid and Saline Zones", (Middle East Regional Cooperation Grant, Project M-20-18) <http://www.desertagriculture.org/sustain.html>, 2005.

Israel's new generation of desalination plant to 55 cents / cubic meter (1000 liters of water).⁴³ Many crops are economically viable at this rate – and desalination prices are likely to drop even further over time.

All the same, surely water, a scarce resource, should not be subsidized when the same support could be funneled through other, more abundant factors of production – such as unemployed workers. There is a compelling national interest to ensure that agriculture continues to provide landscape and ideological returns to local citizens. The risk of abandoning agriculture includes spawning desertification in the southern semi-arid regions. It is also important for national self-esteem for Israelis to know that to a large extent, they do feed themselves.

Because a globalized economy will continue to put pressure on Israeli farmers, they will have to continue to be as clever as ever in developing crops and cultivation methods that can make their desert bloom with as little waste of natural resources and cash outlays as possible. If the past hundred years is any indication, the core of agricultural communities and individual farmers who have survived the vicissitudes of Israel's checkered agricultural history are up to the task.

⁴³ The Israeli cabinet decided on April 4, 2002 to build a series of new desalination plants beginning with a 100 million cubic meter/ year facility in Ashkelon. (Government decision # 1682).