

# **Advanced technologies allow "small dairy farms" in Israel to be competitive**

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## **The agricultural sector in Israel**

Israel's agricultural sector is characterized by an intensive production system, which stems from the need to overcome the scarcity of natural resources, particularly water. The agricultural sector's high level of development is due to the close cooperation and interaction between scientists, extension advisers, farmers and agriculture-related industries. These four elements have joined together to promote advanced technologies in all the agricultural branches in Israel and in the dairy sector particularly. The result is modern agriculture and an advanced dairy sector in a country half of which is defined as desert. Despite the decline in the number of farmers and agriculture's share in the GDP (in 2004 agriculture accounted for 1.5% of the GDP and farmers represented 2.6% of the country's active labor force), agriculture continues to play a significant role as a major food supplier to the local market and is an important factor in Israeli export.

## **The dairy sector in Israel**

The dairy industry is one of the main sectors of Israeli agriculture and supplies the entire domestic demand for milk and dairy products. Israel has a total annual output of approximately 1,150 tons of cow's milk. The dairy enterprises process raw milk into more than 1,000 different dairy products, with an annual value of approximately US\$ 1.5 billion.

Milk is produced on more than 1,000 farms, spread countrywide. There are two main kinds of dairies: Kibbutzim (cooperative societies – 185 large scale farms averaging 300 cows/herd) and Moshavim (private, family farms - 850 small units averaging 60 cows/herd).

The national dairy herd is comprised of 115,000 head of the Israeli-Holstein breed, developed by the Israeli Genetic Improvement System. For many years the Israeli cow has been preferred due to its successful adaptation to the harsh conditions of the Israeli climate, characterized by long, dry and hot summers, and to local diseases. Nearly all the cows in Israel are bred by artificial insemination (A.I.).

The Israeli Herdbook (DHI) receives and processes information from the official Milk Production Control System, which includes 90% of the dairy cattle in the country. In addition to production figures, the Israeli Herdbook incorporates information from the Breeding system and "Sion", an A.I company, as well as from the "Hachaklait", a society for veterinary services. The comprehensive structure of the Israeli Herdbook also provides the farmer with useful multi-disciplinary information that is used for updated management analysis and decision making processes which have led to outstanding world-scale achievements. The Israeli cow has the highest national milk yield in the world, in reference to milk volume, as well as to total annual fat and protein per cow production.

In 2005 the average annual milk production per cow was 11,118 kg of milk, 349 kg of protein and 398 kg of fat. Kibbutz farms (3 milking times a day) averaged 11,540 kg of milk per cow, 344 kg of protein (3.15%) and 397 kg of fat (3.60%). While Moshav farms (mostly,

2 milkings a day) averaged 10,430 kg of milk per cow, 309 kg of protein (3.13%) and 353 kg of fat (3.57%).

## **Organizations and services for the dairy sector**

Financially and otherwise, the dairy sector in Israel is well supported and protected. Milk production in Israel is carried out under a quota system, where the annual volume is divided into monthly quotas. The “basic” price for milk to the producer (“Target price”) results from an agreement between government, farmers and dairy industries. The price of milk to the farmer reflects the average production costs plus an agreed return for the farmer’s labor and invested capital.

The following are the most important institutions supporting the dairy farmer:

1. ICBA (Israel Cattle Breeders’ Association). A dairy farmer organization, representing farmers’ interests in their relations with governmental ministries, professional organizations and industry. ICBA owns the milk control laboratories and milk recording data through the “Israeli Herdbook” and provides farmers with statistical and managing programs and data processing. Farmers own two cooperatives:

- Sion: Genetic improvement and A.I. services
- Hachklait: Clinical veterinary services

2. IDB (Israel Dairy Board). An organization which is jointly owned and managed by representatives of the dairy farmers, dairy processing companies and the government of Israel. IDB objectives are:

- To generate cooperation between all entities.
- To implement governmental policy regarding milk production planning and marketing.
- To improve the professional standards of the dairy industry.
- To promote and support research and extension programs to improve the efficiency of milk production.
- To improve milk quality through the “National Service for Udder Health and Milk Quality”.
- To promote public consumption of milk and dairy products.

3. Ministry of Agriculture & Rural development (MOAG). The Ministry supports dairy farmers by providing public services through the following governmental institutions:

- ARO: Agricultural Research Organization
- Shaham: Extension Service
- Veterinary Institute: for veterinary research and field services for general veterinary health control and vaccinations.

## **Services and technologies assisting small family farms to be competitive**

A variety of supporting services and advanced technologies are available to farmers in the dairy sector in Israel and assist small family farms to be competitive and successful – in their attempt to compete with milk prices and succeed in making a profit. This article will describe four of them:

- Regional “Feeding Centers”
- Computerized milking equipment
- Udder health and milk quality program
- Implementation of “Cooling methods” for cows in summer

## **Regional feeding centers**

Israel was one of the first countries to adopt the Total Mixed Ration (TMR) feeding system. Since the beginning of the 1980's, all dairy cows and heifers in Israel receive TMR rations, distributed to the cows once a day in the winter and at least twice a day in the summer. In the last decade, large scale "Feeding Centers" were installed in different parts of the country, providing farmers with TMR on a commercial basis. Rations are based on a "tailor-made" system, where each farmer or his nutritionist can make their own formulation. Rations are prepared separately for milking, dry, and heifer cows and can be supplied at the feeding center (where the farmer receives the ration directly to his truck) or can be distributed to farmers at the feeding line by the Feeding Center's own vehicle.

A Feeding Center system liberates farmers from dealing with the problems of feeding and nutrition for the cows and leaves them more time to concentrate on better herd management. There are many advantages to Feeding Centers, mainly for the small dairy farms, constituting a more efficient use of infrastructure and feedstuffs, less need for investments in installations and machinery, better quality and fresh feedstuffs and better accuracy in diet formulation. Today, nearly all of the cows on family farms and more than 50% of the cows in cooperative farms are fed with rations supplied from commercial feeding centers.

## **Computerized milking equipment**

Since the beginning of the 1960's, all dairy cows in Israel are milked automatically. Most of the milking parlors in Israel, in cooperative as well as family farms, are equipped with sophisticated milking equipment, manufactured mostly by two Israeli companies – S.A.E Afikim and S.C.R. This sophisticated milking equipment is based on leg or neck sensitive tags. The computerized tags are recognized by special antennas located in the milking unit. They electronically identify cows 2-3 times a day in the milking parlor and transfer the relevant information concerning each cow to the farm computer located in the dairy office. Young heifers are detected in special "gates" located near water troughs. Later on, all this information is transferred automatically to the ICBA computer center, where it is used for genetic improvement, national herd statistics, research in extension purposes and most of all for herd management computerized programs.

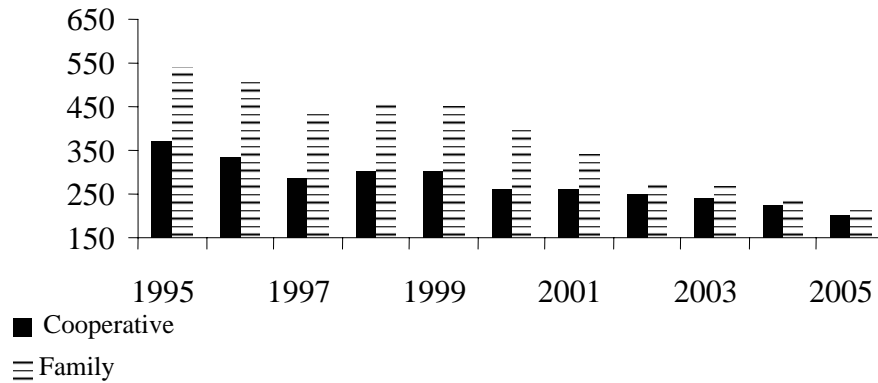
Data collected by this sophisticated equipment includes milk volume and content, milk electrical conductivity (indicator of possible mastitis), cow's activity (indicator of cow in heat), rumination frequency (indicator of possible occurrence of being under stress, or having digestive disorders) and cow's weight (indicator of metabolic status).

Data gained through this sophisticated milking equipment helps dairy farmers to better manage their herds by detecting those cows with health problems and cows in heat, leading to better decision making and uniformity between herds in production efficiency.

## **Udder health and milk quality program**

The national service for udder health and milk quality is a non-profit organization whose objective is to improve udder health and milk quality of all dairy cows in the country. This organization was founded by the IDB and provides all dairy farmers with laboratory diagnosis and services as well as supervision and advice on milking equipment practices performed by the program's veterinarians and technicians. It is this service that has been accredited with the

impressive improvement in milk quality observed in the last decade in Israel, especially at the level of the small family farms, as can be seen in Figure 1.



**Figure 1.** Trends in somatic cell count SCC,(000/ml) in milk produced in Israel between 1995 - 2005.

### Implementation of "Cooling methods" for cows in summer

Summer heat negatively affects the production and fertility of the high yielding cows in Israel and creates a significant seasonality in milk supply to the dairy industry. Summer negatively affects the cows and production efficiency on the farm as well as in the processing industry. On the farm level, the summer production decrease to nearly 90% of the winter level leads to the need to maintain more cows for a certain amount of milk. At the industry level, seasonality in milk supply leads to the need to dry excess quantities of milk in the winter, store it and use it in the summer, leading to an increase in the cost of processing.

More than 30 years of research led to the development of efficient cooling methods to combat the heat constraints. During the last two decades these methods were installed in most of the dairy farms in Israel, first in the cooperative farms and ultimately on many small family farms. A computerized report developed by the Ministry of Agriculture and Rural Development, Extension Service, and based on ICBA data, analyzes annually the efficiency of the implementation of these cooling methods from the viewpoint of the farm. Comparing and using the parameters of summer production and fertility traits to those obtained in winter, enables us to follow up the advances made in summer milk production during the last decade in the cooperative and family farms, as described in Table 1.

**Table 1.** Trends in summer (S) and winter (W) average daily milk and ECM production ratio (%) and Summer rate of decline in CR in cooperative and family farms in 2005.

	Cooperative farms	Family farms
Number of farms	195	495
Summer milk production (kg/d)	35.4	32.2
Summer : winter milk production ratio	0.97	0.97
Summer : winter milk production ratio	0.93	0.93
Summer decline in CR (% units)	23	25

## The reform in the dairy sector in Israel

During the last eight years since 1998, Israel has been under a period of “reform in the dairy sector”. This reform was signed by ministries of agriculture and finance and the IDB. The main goals of this reform were:

- To prevent environmental pollution created by dairy farms.
- To reduce the number of farms and increase farm size, with the aim to improve milk production efficiency and reduce market milk price.

Between 1998 and 2006, total authorized investment in the 850 small farms in Israel reached US\$ 250 million (averaging US\$250,000/farm and US\$ 4300/cow). Government grants (40% of expected investment) will reach at the end of the reform process US\$86 million (averaging 100,000 U.S\$/farm and 2000 U.S\$/cow).

The Reform’s effect on the reduction of the number of small farms and the increase in these small farms’ average size can be seen in Table 2.

**Table 2.** Trends in number of family dairy farms in Israel 1998-2005.

Year	Farms	% of 1998	Sector production (million liters)	Av. farm production (000 liters/year)	% of 1998
1998	1211	100	470	389	100
1999	1175	97	474	404	103
2000	1091	90	469	430	110
2001	1025	85	479	468	120
2002	962	79	478	498	128
2003	921	76	467	508	130
2004	880	73	475	541	140
2005	855	70	478	560	144

The number of small farms in 2005 in Israel reached 70% of their number in 1998, while their size increased in the same period nearly by 45%. During this period, the volume of milk produced remained stable, due to a small decrease in per capita consumption and an average annual increase of nearly 1% in population size.

Due to the use of the above described supporting services together with the adoption of advanced technologies, the small dairy farms presented a significant improvement in the last decade in milk production, milk content and fertility traits. This is described in Table 3.

**Table 3.** Trends in production and fertility in small family dairy farms 1994-2004.

Year	Milk (Kg/Year)	Fat (%)	Protein (%)	Conception Rate (%)
1994	9300	3.12	3.00	36
1995	9650	3.18	2.99	37
1996	9580	3.24	3.02	37
1997	9860	3.31	3.06	36
1998	9870	3.28	3.08	32
1999	10040	3.29	3.07	35
2000	10220	3.37	3.06	35
2001	10210	3.43	3.07	34
2002	10120	3.46	3.10	33
2003	10190	3.55	3.08	34
2004	10520	3.59	3.08	34
2005	10920	3.50	3.08	31

From the data presented in Table 2, one can see that milk production on small dairy farms increased during the last decade by more than 17%. Fat and protein percentages increased as well, while, unexpectedly, conception rate remained stable. The same magnitude was observed during the same period on cooperative, large scale dairy farms. The results presented in Table 2 reflect the improved management practices provided in Israel by small and large dairy farms.

In the last five years, Israel, through IDB, has been a member of the International Farm Comparison Network (IFCN) Institute, located in Germany. In 2005, an analysis was made of 102 typical farms from 33 countries, representing nearly 75% of the world's milk production. Israel is represented by two dairy farms, a cooperative farm (260 cows) and a family farm (65 cows). Data presented in the 2005 report are presented in Table 4.

**Table 4.** Efficiency of production on small family dairy farms (65 cows) and in large dairy farms (260 cows) in Israel (Source – IFCN report, 2005).

	Small farm 65 cows	Large farm 260 cows
Milk yield (Kg ECM/Year)	9,700	10,700
Milk price (US\$/Kg ECM)	0.400	0.405
Cost of milk production (US\$/Kg ECM)	0.310	0.305
Profit (US\$/kg ECM)	0.09	0.10
Labor productivity (kg ECM/hour)	175	170

From the data presented in Table 4, one can see that despite the difference of 12% in the level of milk production (mainly, due to 3 and 2 times milking/day in family and cooperative farms, respectively), all other parameters indicate that the efficiency of production in 2005 was similar in small and in large dairy farms, although cooperative farms are 5 times bigger. In our opinion, the supporting services and advanced technologies on one side, and good labor management on the other side, are the main factors responsible for these results.

## **Conclusion**

Due to government grants, supporting institutions providing free services and the adoption of advanced technologies, small family dairy farms in Israel have:

- Increased in size.
- Improved milk quality.
- Increased per cow milk production and content.
- Reduced “seasonality” in milk supply to the industry.
- Maintained normal fertility.
- Increased production efficiency.
- Have reached, unexpectedly, competitiveness towards large scale farms.