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# Soil Contamination by Excess Fertilizers and Water Waste in the Gerbera Cultivation Area in Central Sharon 1989–2009

**Summary of a lecture held on January 24, 2013, at the Sharon Ltd. Flower Packing House in Tel Mond, attended by gerbera growers, instructors from the Agricultural Extension and Rural Development Service) of the Ministry of Agriculture, and packing house managers.**

**Lecturer: Dr. Yoseph Shoub – Gerbera plant researcher and breeder of gerbera varieties adapted to Mediterranean and subtropical climates.**

Most of the gerbera farms growing flowers for export from Israel between 1989 and 2009 were concentrated in the Tel-Mond block (Sharon region), within five adjacent settlements, covering approximately 600 dunams (600,000 meters) in greenhouses heated during winter. These were: Porat, Azri'el, Kfar-Hess, Ein-Vered, and the Yedidia-village, which is somewhat distant from the others.
The gerbera growers were guided by instructors of the (Agricultural Extension and Rural Development Service).

**During these years, gerbera plants were cultivated in local sandy soil, in narrow and elevated beds (30–40 cm high), formed by a specially designed local tool towed by a wheeled tractor. The plants were planted after soil fumigation of the beds using methyl bromide gas (to control nematodes)**.
Gerbera cuttings rooted by the growers, as well as laboratory-rooted seedlings, were planted along the sides of the beds (usually in the fall), spaced 30–40 cm apart between the two rows (**approximately 5,500 plantlets per dunam**).

**"Fertigation"** (fertilizer + irrigation) **refers to watering with water containing various fertilizers dissolved in 3 large tanks by the growers. Macro and Micro fertilizers in the first tank, The Acid in the second Tank, And the third Tank for the Calcium and Magnesium**.

The fertilizer solutions were pumped into the irrigation lines. According to the recommendations, the fertilizer dose in the irrigation water was approximately 850 grams of fertilizer per cubic meter of water. Therefore, the cumulative fertilizer quantity per dunam per growing year reached approximately **1,275 kg**. The fertilizer solutions drawn from the tanks once a day, using automatic electric valves and fertigation pumps

The beds were irrigated by two lines of drip pipes, with each dripper discharging 4 liters per hour. One irrigation pipe was placed next to each planted row, adjacent to the line of the plants. These automated fertigation systems were operated without regard the weather conditions or the plants' physiological activity. Thus it happened from time to time that the fertigation quantities past overstep the saturation-point in the beds root zone.

The daily fertigation volume was single-minded by the instructors and the farmers based on their personal experience. During the warm months in the greenhouses (mid-March to mid-November), the water supply was set at 5 cubic meters per day per dunam resulting in approximately 1,200 cubic meters per dunam in the hot season. During the cooler months (late November to mid-March), the irrigation volume was approximately 300 cubic meters per dunam.
**Total annual irrigation: 1,500 cubic meters per dunam.**

So, when these fertigation quantities combined with the excessive discharge rates (4 liters per hour), and the drops touch and joined each other, it developed to rapid gravitational movement of the fertigation water, and

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formed the well-known **"salinity fronts"** in the lower part of the growing beds (see page 3)**.** The root zone above the salinity front was even colloquially called by the growers **"the wetting onion"**.

Due to these known effects, the gerbera growers advised to continue the daily irrigate with the 5 cubic meters per Dunam without the fertilizer, merely to washout out the excess fertilizers accumulated in the roots zone.

When such irrigation stopped, an osmotic movement develop up, drawing the unused fertilizers upward toward the soil surface creating salinity conditions that quickly damaged the root system.

**Therefore, it is essential that the Israeli growers will start to use the automatic irrigation control systems, for managing their crops in the greenhouses and in the open fields.**

In our Gerbera Breeding Farm we used successfully for the last 20 years the "**AutoAgronom" Fertigation control System.** See please our website: http://www.gerberaisrael.com/

And in the last 4 years we are using successfully the "Roots Talk" System
See presentations on the website: https://www.roots-talk.com/

**Summary: Soil Contamination by Excess Fertilizers in the Gerbera Cultivation Area in Central Sharon**

**Based on experience learned via the "AutoAgronom" fertigation control system, along 20 years of gerbera cultivation, and about 100 other different plants species in our farm, we clearly observed that: about 70% of fertilizer quantities and about 40% of water volumes recommended by the instructors could have been saved.**

**Firstly it his is because: plants do not absorb minerals beyond what is needed for their growth, and secondly, reducing fertilizer application significantly lowers the volume of water required to flush out excess fertilizer and may even render such flushing water is mostly unnecessary**.

**Fertilizer Leaching and Groundwater Contamination**

**Based on the above assumption, it is estimated that around 10,000 tons of fertilizer were leached into the groundwater during 20 years of gerbera cultivation in the Sharon valley result of 70% over-application of fertilizers across a relatively small cultivated area of about 600 dunams.**

**Excessive Water Use**

**According to our calculations, the use of AutoAgronom-controlled fertigation in the above-mentioned gerbera cultivation area could have saved approximately 2,400,000 cubic meters of water during the drought years (2004–2009),**
**based on the high water quantities recommended for gerbera fertigation roughly 40% more than the actual water consumption**.

**Dr. Yoseph Shoub** **E&OE (Errors and Omissions Excepted)**

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# Stages Development of Salinity Fronts

# and Low Relative Humidity in Intensive Crops

**Under Salinity Conditions**

Accumulation of Salts in the Growing Medium

↓

The root tips become scorched, and their growth is halted.

↓

Disruption in water uptake from the growing medium

↓

**Under conditions of salinity and low humidity**

The rate of water evaporation from the leaves exceeds the rate of water uptake by the roots.

↓

The plant regulates water evaporation by closing its stomata.

↓

When the stomata close, the following processes occur in the plant:

A decrease in humidity in the leaf area

↓

Leaf warming

↓

Increase in salt concentration in the leaves

Prevention of $CO_2$ absorption

↓

Stop in sugar production

↓

The level of salts increases in relation to sugars.

## Final result

There is no energy supply for growth, and growth stops.

## Accompanying result

Accumulation of growth-inhibiting substances in the leaves

## The economic damage to the grower

The cessation of sprout awakening,

No new branches will develop,

There will be no flowers, and no roots will develop.