Advanced accurate Agriculture Practice & Theory Selected chapters:

'AutoAgronom - A proven Sustainable Concept '

Lecture in Mexico

Dr. Yoseph Shoub
Gerbera Breeding Ltd. Israel
Photos by the author
Revised April 2021

AutoAgronom - A proven Sustainable Concept ('AA')

Sustainable Precision Agriculture ('SPA')

(Seminar lectures given to vegetable growers and winegrowers, Mexico June 2012)

The AutoAgronom Irrigation Control System

Developed, programmed and manufactured by

AutoAgronom Israel Ltd.

www.autoagronom.com

A presentation by Dr. Yoseph Shoub

Gerbera Breeding. Ltd Israel

A user of the AutoAgronom system since 2005

www.gerberaisrael.com

Our Gerbera varieties are selected under ‘AA’ growing conditions.

Crisis management policy in Agriculture *

Crisis management policy of intensive agriculture, lowers the plants' productivity, as it do not follow, in real time, the rhythm of the plants' Physiological activities and their needs of water and minerals. According to this policy the growers are advised in advance, when and how much to irrigate and fertilize, and it always much more than the plants are used in fact. Such situation avoids the presence of oxygen in the roots-volume and reduces the plants activities. These factors are causing also the 'Salinity' problems. In addition; such intensive agriculture, wastes natural resources and decreases the growers' income. And above all it contaminates continuously the drinking water aquifers. These are few reasons why intensive agriculture requires an essential change, and it's about time for managing '**Sustainable Precision Agriculture**' *('SPA').*

* In the matter of our subject ,"Crisis management" means: Decision taken to change procedures while identifying the problems that already occurred. For example: *Water stress in plants, or Salinity formation.*

In the photo:
'Soil-solution' drain *(not used)*, between 2 soil-beds of cucumbers, irrigated by a conventional drip irrigation.
Mexico, June 2012

It clarifies -
How without precise control, the conventional drip irrigation enriched with fertilizers, endangers the agricultural crops, and the growers' income.

- ✓ The enriched 'Feeding-solution' is wasted.
- ✓ Oxygen presence in the roots volume is prevented.
- ✓ Salinity conditions develop.
- ➢ And as a result, the soil and the aquifers are contaminated.

Just as that!

How Plants adjust themselves to the environments !

They act *(for themselves)* - like A Meteorological, Chemical, and Biological 'monitoring-probe'.

And they react to - the environmental conditions by their developing and growing pattern.

However; their developing-pattern depends on roots Presence, and their ability to absorb and transport water, oxygen and minerals to the above soil organs.

Therefore; for Efficient Intensive Agriculture; Constant presence of optimal water quantity at the roots volume is a vital precondition'.

And as growers this is our responsibility!

'AA' papaya, 8 weeks after germinating.
Growth of 85cm (1.5cm/day) Nov. 2010.

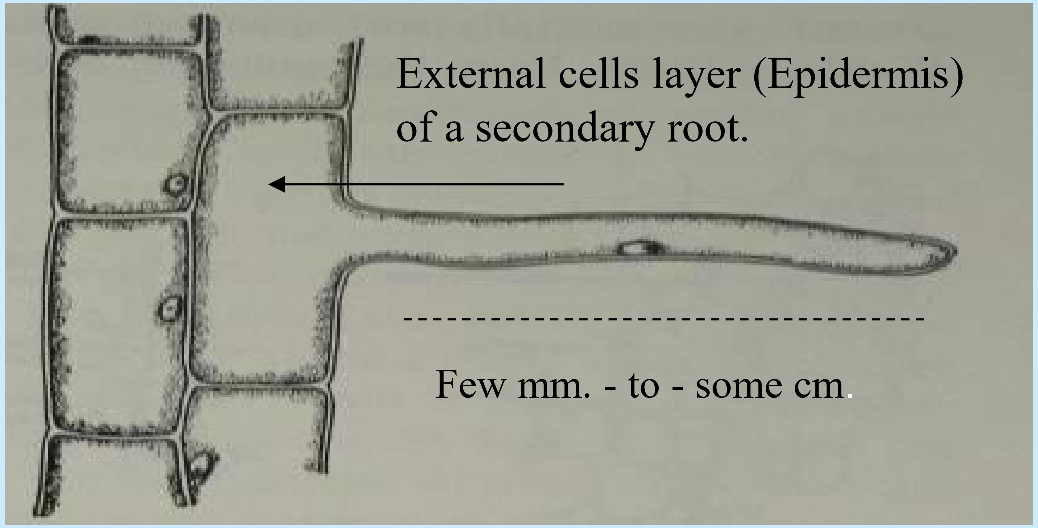
Constant water absorption ensures the plants vitality, maintaining the turgidity, and the movement of the soil-solution through the plant organs.

The Roots Do the Work -

The root hairs and their function:

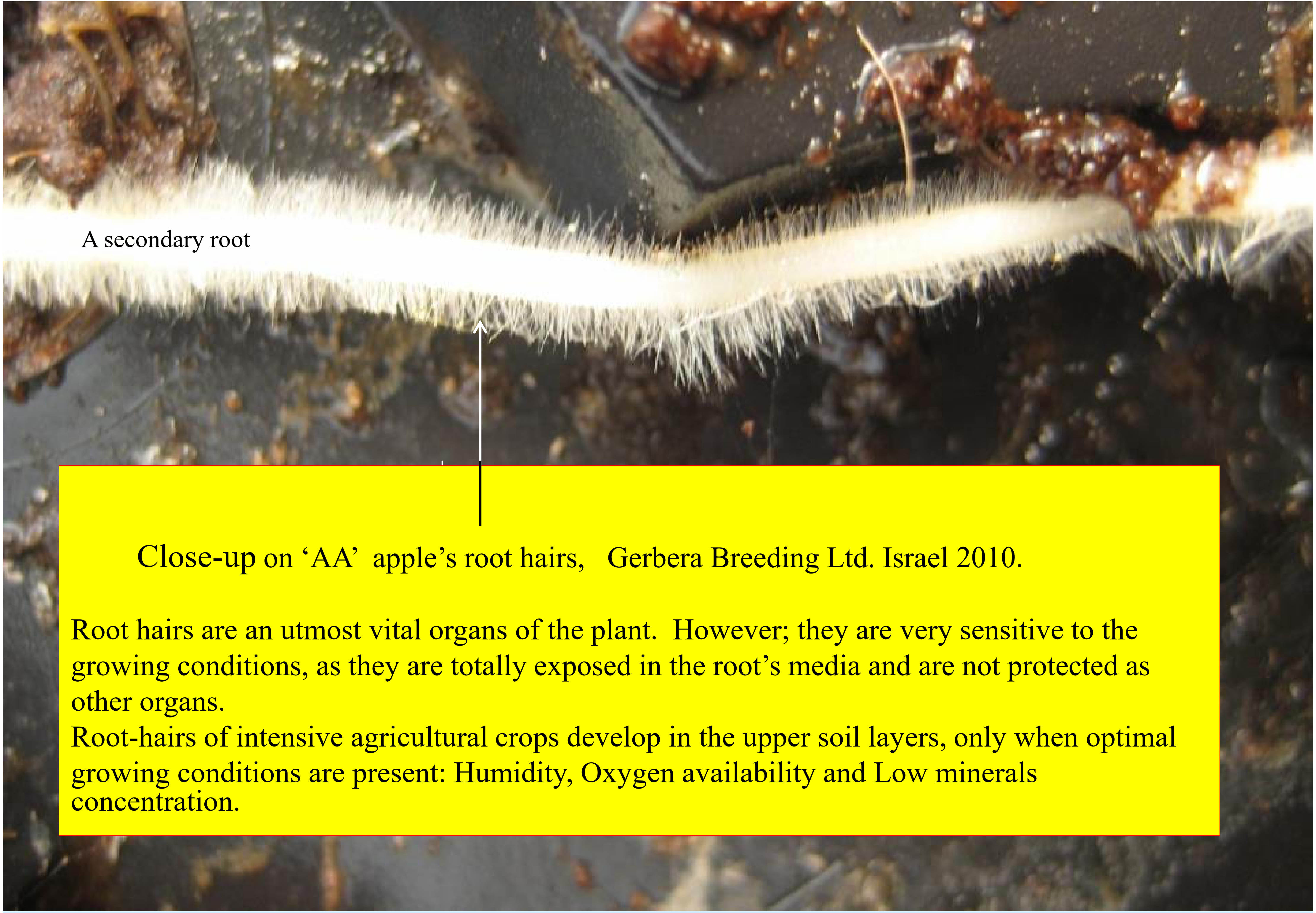
Root hairs are external epidermis cells.
They are located on the secondary roots.
Their function is to absorb and to transport water, oxygen and minerals to the plant's organs.

The productivity of intensive agricultural crops, is totally depend on the root hairs.



A scheme of a root hair

Secondary roots of 'AA' - Chives (Asphodel)
3 years after Planting. May 2010.



Close-up on ‘AA’ apple’s root hairs, Gerbera Breeding Ltd. Israel 2010.

Root hairs are an utmost vital organs of the plant. However; they are very sensitive to the growing conditions, as they are totally exposed in the root’s media and are not protected as other organs.
Root-hairs of intensive agricultural crops develop in the upper soil layers, only when optimal growing conditions are present: Humidity, Oxygen availability and Low minerals concentration.

Crowded secondary roots of 'AA' Pepper, in soil irrigated with salty water (3.6 milimhos), 5 months after transplanting . Ein Yahav, Israel March 2005

‘AA’ Corn (AutoAgronom versus - Control plot controlled by a system known in China as the best irrigation control system. Grow in uniform Sandy-soil, fertigated with the same Compensated drippers-lines, using the same local water quality (0.2 milimhos).

The accumulated experience of intensive agriculture, and the enormous development of agricultural research, promoted modern agriculture almost in all aspects to a high professional and economic level.

However, four outdated critical questions, have not been answered, yet:

When to irrigate?	How much to irrigate?
When to fertilize?	And how much to fertilize?

Although it look like simple questions; many answers have been accumulated, partly based on personal experience and partly on experimental basis.

Yet, these answers do not supply the growers with a professional, measurable quantities, of the exact water and minerals, needs by the plants, for matching the economical production-potential of the plants we grow.

Applying the ‘AA’ method and technology, provides the ultimate answers to these four questions.

The ‘AA’ concept is introducing a new approach to Agronomy *

The key advantages of the ‘AA’ method are:

> ‘AA’- plants manage themselves, in real-time, by the ‘AA’ sensors. It creates in the roots media an ‘Optimal Water/Air Ratio’, that encourage the secondary roots’ growth.

> ‘AA’- systems prevent water stress and increase the yield of many varieties.

> ‘AA’ - systems reduce the contamination of the aquifers by significant reduction of the water and the fertilizers used’ unnecessarily by the growers.

The achievements of the ‘AA’ method in many crops, and in different types of soil and media, demonstrate why the method is an optimal solution to maximize the production - potential of Agricultural-crops, just by following - the plant’s physiological actions.

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* The Crisis management should no longer direct our intensive irrigated agriculture.

Some definitions regarding Plant Physiology Processes -

- Biochemical and physiological processes,* in plants as well as in animals, occur only in aqueous solutions, and are depend totally on water supply.

- During the day - Water is supplied from the roots to the leaves for:
  - Preventing radiation and heat damages by cooling the leaves tissues (Transpiration).
  - Carrying out the Photosynthesis processes, producing the sugars (Assimilation).

- During the night and the day-
  - Water is supplied from the roots to the leaves, for diluting the concentrated sugars.
  - And at the same time transporting the assimilates, the minerals and the growth-control Hormones, from the leaves to all other developing plant's organs. (Sink).

- 24 h Ongoing processes : Growth - cell division and elongation. Growth control - hormonal processes. Metabolic processes - converting the assimilates to the essential nutrients (Carbohydrates, Proteins, Fat), etc.

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* Breathing, oxidation, metabolism, growing, reproduction and more.

Two types of water movement involved in the plant physiological activities -

- Passive water movement - Is conducted via the vascular system, from the roots up to the leaves, for the transpiration of water vapors, carrying also the soil minerals. The plant do not need to invest energy in this movement.
- Active water movement - Occurs through the cells membranes of the leaves and the phloem system (the peel).

  It transport the assimilates and the minerals to all the growing sites of the plant.

  This movement depends on continuity supply of Oxygen - the primary source for the energy needed to activate the passage of the sugars solution, through the cells membrane in the leaves and in the plants peel.
- The only way for plants to get the free Oxygen needed in all its active actions, comes from the atmospheric air presented in the capillary structure of the soil. And only small amount of it is dissolved into the water of the soil solution.
- The soil-solution is absorbed by the roots-hair which exist on the secondary roots.

Water Stress in plants - is linked both to the character of the water movement in the plants and of the soil-solution movement in the roots media,

> Plants under developing stress, slowdown gradually their physiological activities.

> During water stress; the transpiration rates through the leaves - are higher than the ability of the roots to reload the transpired quantities, taken from the soil solution.

> The roots' ability to supply water is faster than the free water movement in the soil.

> The plants reactions to water tension's changes in the growing media are faster than the reaction of the commonly used measurements appliances *(Tensiometers)*.

> Avoiding early stages of water stress - avoids accumulated water deficit.

The 'AA' systems detects even minor changes of the water tension in the growing media, and reacts in 'real time' by returning the small water quantities used by the plants.

The first and foremost preconditions for improving the growth of intensive crops is achieving in the roots media the best growing conditions.

In other words; Achieving, the "Optimal ratio" of water, air and minerals.

Such optimal ratio, in the roots volume, allowing constant growth of the secondary roots, especially as it improve their ability to absorb easily and continuously the soil solution.

In any case; it is quite clear that the plants are interested **only** in the available soil-solution, and not in the soil type or in the soil character.

These parameters are the grower's concern: How they will create the Optimal growing conditions in their diverse land plots.

All that means: The plants are able to develop their secondary roots system, in any media or soil type, only if the "Optimal ratio of water/air/minerals," is existing.

An Accurate Drip Irrigation can creates the desire 'Optimal air / water ratio'-

In spite of the accumulated data of Plant physiology research, the applicable information has not been integrated correctly, regarding the **dripping** irrigation practices (1963 - today).

S0;What & Why we need to update the dripping irrigation systems?

> Like any other biological system; the Developing and the plants growth followed the 24 hours daily cycles. And It totally depends on the environmental conditions. Among these conditions; water, oxygen and minerals have the most influence effect on the continuity of the growth and its quality.

> Hence, the most important actions in agriculture; **Supplying water, oxygen and minerals,** are done, in most cases, by a predefined programed schedules, and not according to the "real-time" rhythm of the plant's physiological activities, or not according to the plants' actual water-use along the daily cycles.

> Growers today use to Fertigate by - programmed ahead - exaggerated water quantities. And the results are - Reduction of the growth intensity, the yields, the growers income, and the aquifers contamination.

Official-Recommended irrigation program* for Bananas in the Jordan Valley, Israel.

Submitted on 2009 for 2010 - Versus actual irrigation quantities of 'AA' Bananas throughout 2010, Kibbutz Sha'ar Hagolan, the Jordan Valley, Israel.

Irrigation quantities / cubic meter per 1000sqm

Month	Recommended Daily	Recommended Monthly	'AA' actual quantities Daily	'AA' actual quantities Monthly	variance %
January	0.7	22	1.51	47	**214**
February	0.7	20	1.36	38	**190**
March	1.5	47	1.40	43	91
April	4.0	120	1.96	59	**49**
may	6.0	186	5.24	162	87
June	10.5	315	6.03	181	**57**
July	14.0	434	7.18	223	**51**
August	15.0	465	7.25	225	**48**
September	11.0	330	6.26	188	**57**
October	6.5	202	4.26	132	**65**
November	3.6	108	3.38	101	94
December	1.6	50	2.00	62	**124**
Total water (M3)		2299		1461	**64%**
Total fertilizers (Kg)		75		19	**25%**
Production (Kg)		**10,220**		**10,560**	103%

** Recommended Irr. program, prepared by: 'The Extension Services, Ministry of Agriculture & Rural Development, Israel' December 2009*

The production efficiency of any intensive crop, depends on the ability of the secondary roots to develop and act optimally.

The Banana Leafy-stem base

is a stockpile of adventitious roots,

the location for the secondary roots.

The outcome of irrigation controlled by ‘AA’ system - Versus a conventional drip irrigation on banana’s Secondary roots, grown in heavy clay soil of the Jordan Valley, Israel October 2010.

Under conventional irrigation

controlled by ‘AA’ system

Once more: **“The plant is interested only in the soil solution! The soil type and the soil character are the grower’s concern!”**

Unlike the programmed irrigations -

The ‘AA’ concept deals with supplying water (15 - 40cc) on “real time” back to same soil volumes from where the water have been taken (= used by the plants).

Under ‘AA’ conditions the wetting volumes are limited, but packed full with secondary roots.

4 liter container

Secondary gerbera roots controlled by ‘AA’ system.
September 2012 - 3 months after transplanting.

1.5 years old ‘AA’ Olive trees.   Hula valley Galilee, Israel December 2011

‘AA’ Gerbera seedlings,
2 weeks after
transplanting.

4 plants per 4L. Container.

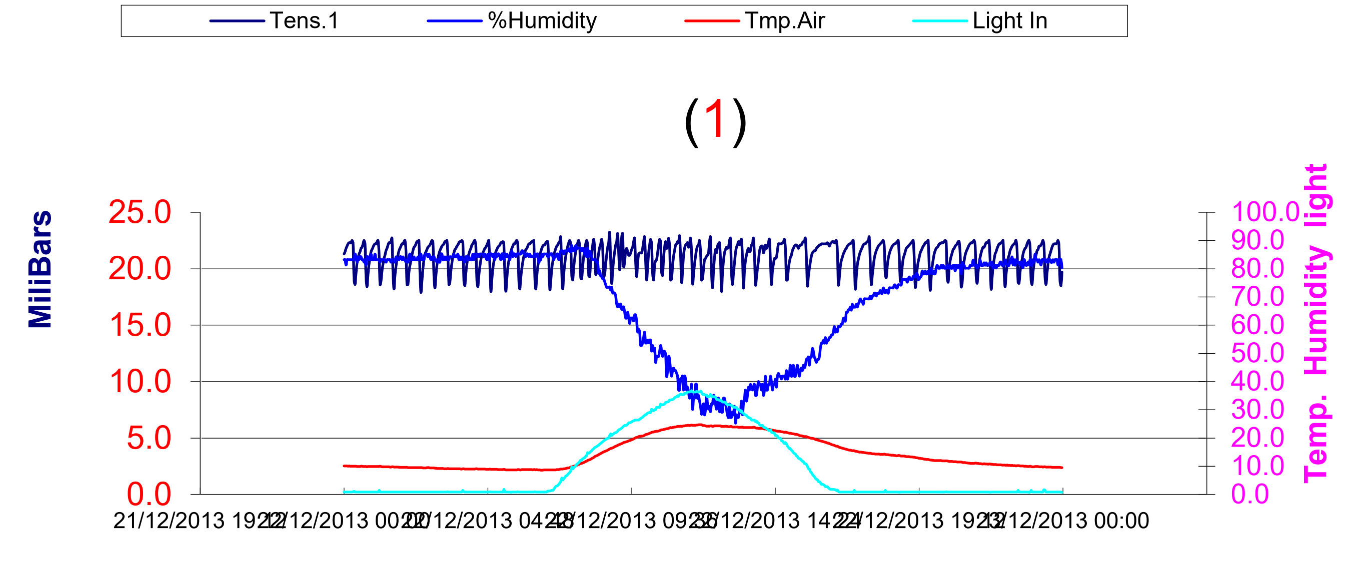
Our new
'AA' Mini gerbera
Variety (No. 102-49)
"Colombian flare"
9 weeks after
transplanting.
June 2014.

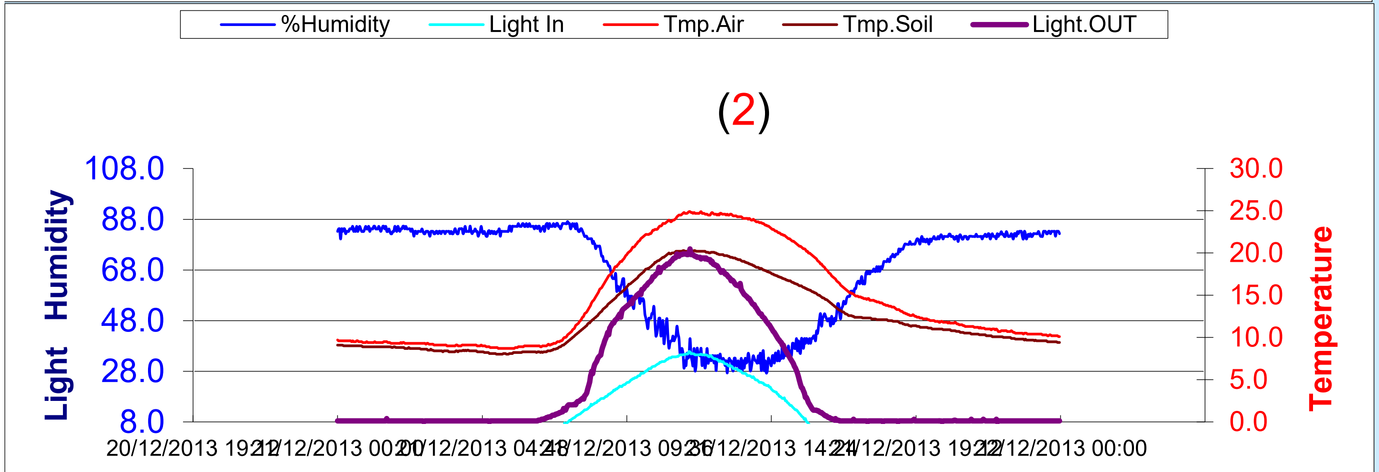
'AA' gerbera seedlings 59 days after transplanting. June 2014

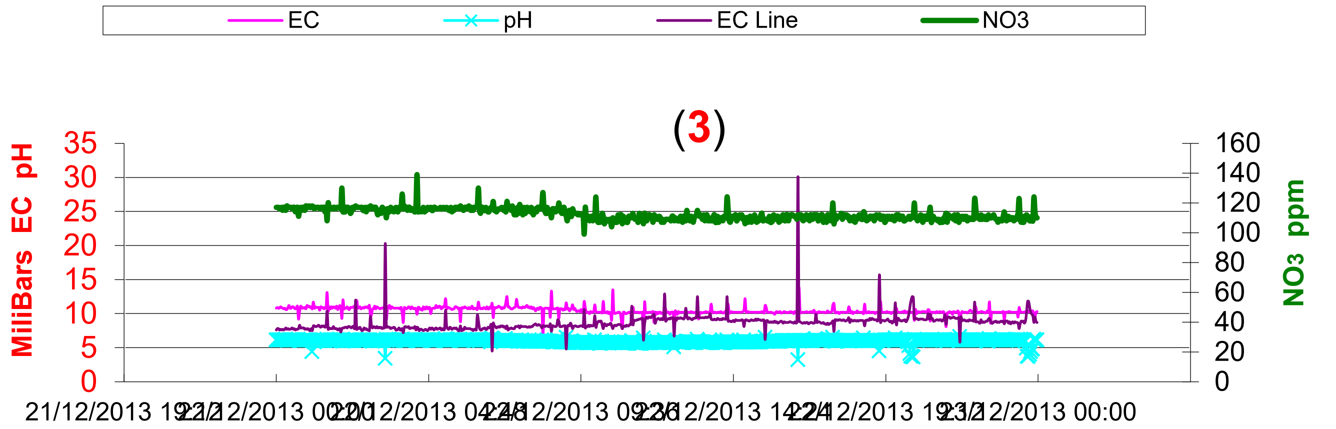
‘AA’ advantages achieved in Gerbera Breeding Ltd, Israel 2005 - 2021:

- 4 seedlings in 4L. container, instead of 1 plant in the previous systems.
- 110 days to end the selection phase, compare to 200 days as before.
- 3 growth-cycles per year in the same container - equivalent to 12 plants per container per year, compare to 1.7 plants in the previous systems.
- Saving 30 - 50% of the water per plant.
- Saving 70% of the fertilizers.

4 ’AA’ gerbera seedlings in 4 liter container, 3 weeks after transplanting. Gerbera Breeding Ltd. Israel 2014.







The AutoAgronom Controls the roots environment in real time -

Daily 'AA' management graphs of growing conditions, in our Gerbera – greenhouse.

Ganey Am, Israel 22.12.2013
(out of data bank of 9 years)

Physical values - (1, 2)

Water tension
Relative humidity
Temperatures: **Air** and **Coco media**
Light in - **light out**

Chemical values - (3)

NO_3 - drainage
EC - drainage
EC - feeding solution
pH - feeding solution

(Oxygen availability in separate graphs)

Mineral absorption by the plants -

The common statement is that under normal growth conditions, the total "dry matter" weight of the plants' structure - *that builds the plant's body and its products* - is correlated to the amount of minerals absorbed by the plants.

But; although it known that the "Soil minerals"* compose only 8% - 15% of the total plant's dry matter, Agricultural Organizations and Fertilizers Companies, recommend and publish Fertigation programs that include excess quantities of fertilizers, way above the amounts needed by the intensive plants to build their structure and their products.

As a result; the excess minerals accumulated in the root zone are causing the risky **Salinity**' phenomena, developed in soil, as well as in the plants organs' tissues. *(see slides 28 to 37)*.

Salinity development is the most endanger phenomena that reduces the plants production.

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* The source of the so called "Soil minerals" are the industrial fertilizers.

Leaves' deficiencies identified by leaves-analysis, are not direct evidence of minerals deficiency in the soil. But probably difficulties of minerals absorption by the roots.

Leaf of a tree irrigated by 'AA' system,
20 Liter/day + 8.5L total fertilizers / season

Leaves of a tree irrigated every 4 days 240L
60 Liter/day + 95L total fertilizers / season.

Leaves analysis -

Mineral content of Bean leaves (Almeria, Spain).
A comparison between conventional feeding (100%)
and 'AA' reduced formula (38%).

(Sampling date 20/01/2010)

Fertilizers Milligram / Liter		**Control 800**	**'AA' 300**
Minerals % of the Dry matter	**N**	**3.6**	**4.0**
	P	**2.0**	**4.5**
	K	**1.6**	**1.95**
	Ca	**3.5**	**3.2**
	Mg	**0.8**	**1.6**
Total % Dry matter		**11.5**	**15.3**
ppm.	**Fe**	**59**	**82**
	Zn	**29**	**38**
	Mn	**42**	**70**
	Cu	**3.6**	**5.5**
		100%	**147%**

% Dry matter of some intensive crops

* 'Soil testing and plant analysis 1973'
** Self information

Gerbera**	Peanuts*	Tomatoes*
2.9	**3.6**	**3.5**
0.5	**0.28**	**0.6**
3.1	**2.56**	**3.1**
1.2	**1.3**	**4.5**
0.5	**0.4**	**0.7**
8.2	**8.1**	**12.4**
180	**160**	**13**
40	**45**	**25**
126	**182**	**62**
21	**12**	**7**

A reminder:

It is well known that during the development of the plant structure and its products, only 5 - 10% of the common advised minerals *(fertilizers)* supplied by the growers are used by the plants.

It is well known that 85 - 90% of the plant's dry matter compose of the Photosynthesis-products built of: Carbon (C), Hydrogen (H), and Oxygen (O).

The origin of these 3 Elements (C, H, and O), is in the air and in the water, therefore they are for free. Just remember it.*

The other Macro elements: N, P, K, Ca, Mg, S, and the Micro elements supplied via the fertilizers, compose only 10 - 15 % of the plant's dry matter.

*

The origin of the "Essential nutrients" - Sugars, Proteins and Fats, is the primary mono-sugar "Glucose" $C_6H_{12}O_6$ synthesized by the plants out of these three free elements. Just remember it.

Dripping water movement in the soil and "Salinity" development -

1963 - the dripper was invented as an Israeli answer for the crucial necessity of saving water.

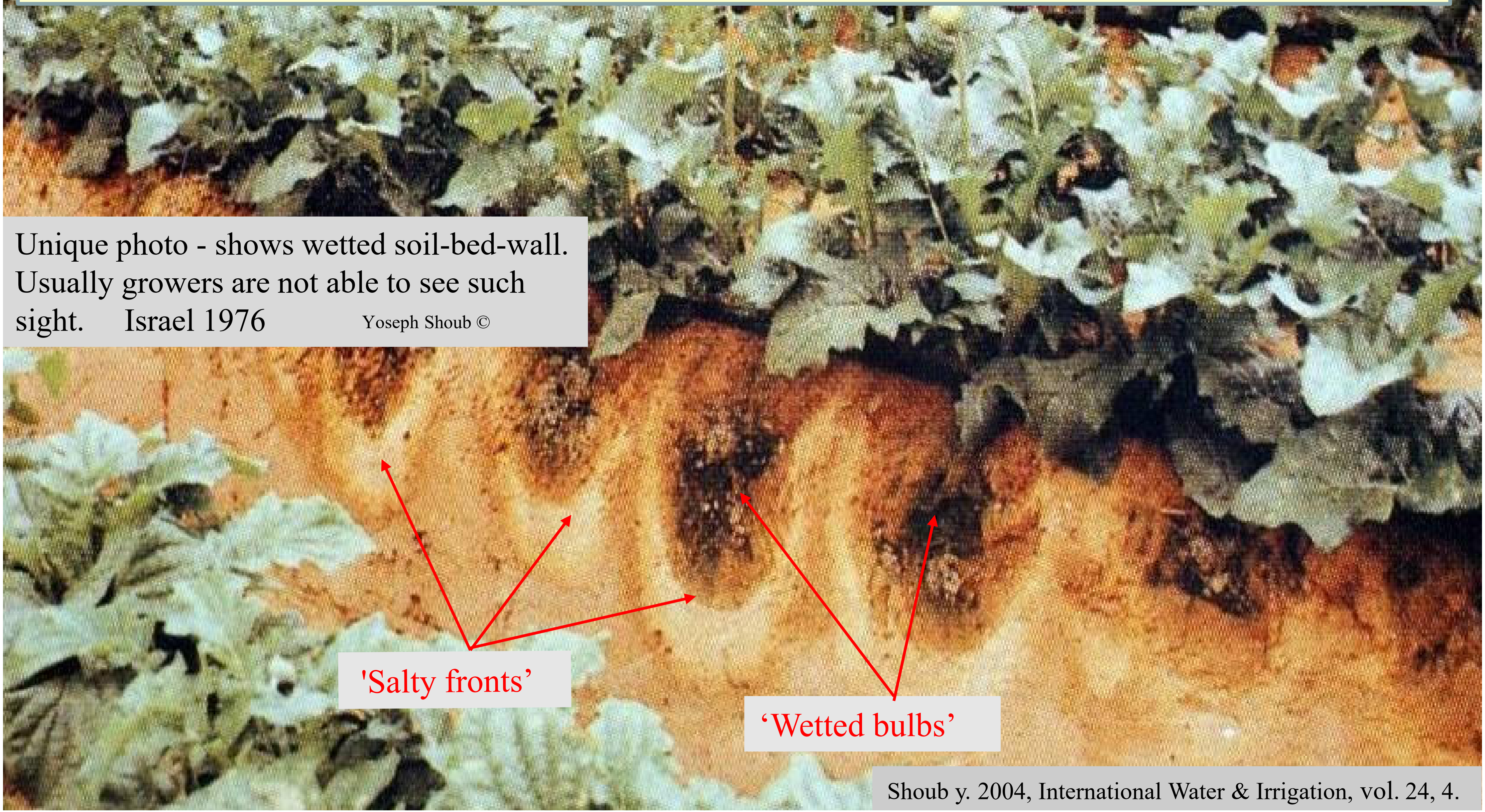
In practice the growers found out that above water saving, there are additional advantages:

- Dripping irrigation can be used for dissolved fertilizers ('Fertigation').
- Dripping creates defined "wetted bulb shape". A restricted wetted volume, bound to the roots' volume, and location.

The invention of the dripper enabled a global change in irrigation and fertilization methods, and led to huge savings of water and an increase in yields.

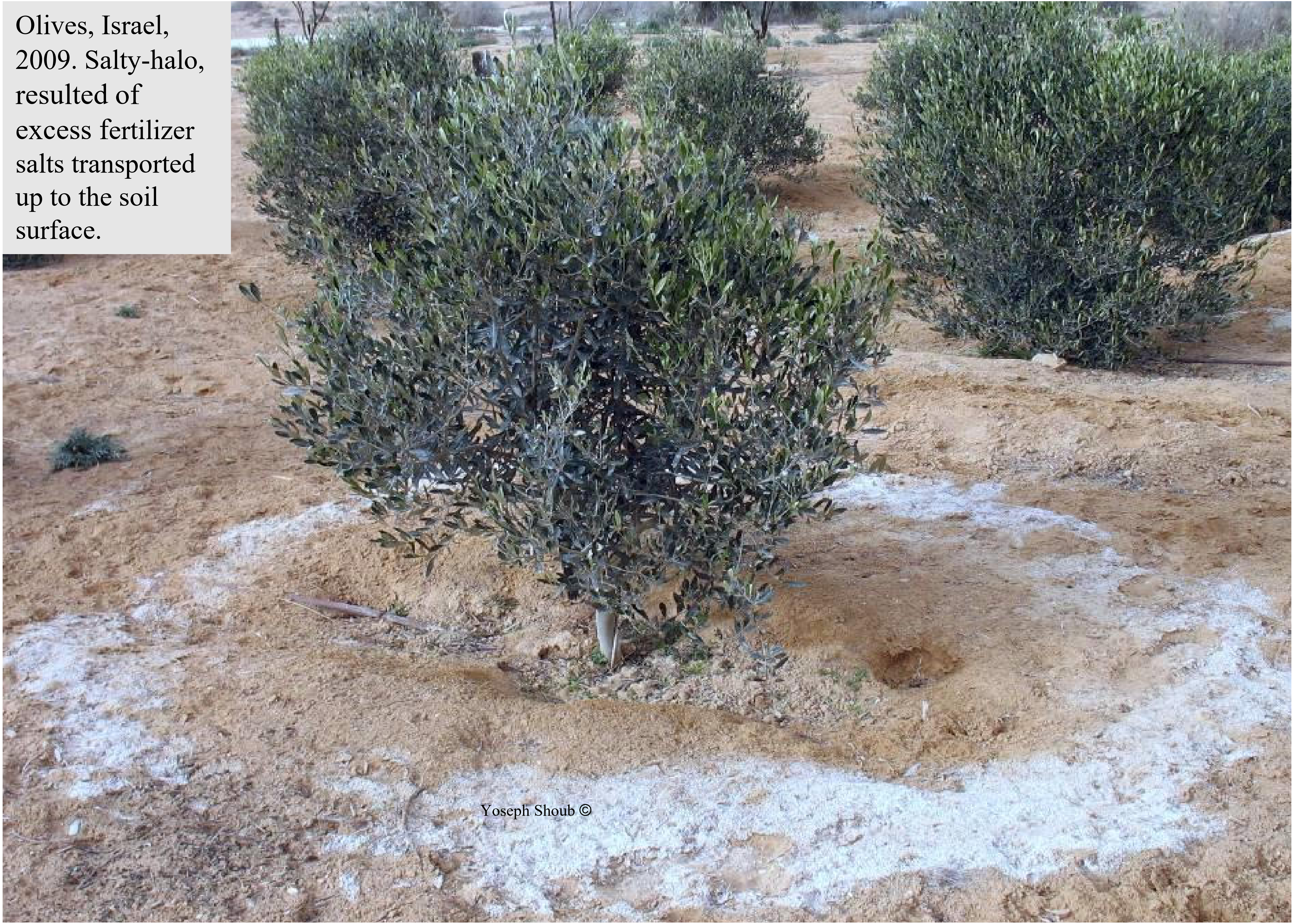
But on the other hand - (…..)

On the other hand - Water movement of a conventional (2L) dripper is a gravitation movement. The dissolved minerals movement in the soil is producing below any conventional dripper 'salty front' bounds around the 'Wetted bulbs'. These salty fronts appear later as salty-halos on the soil surface, and this is what the growers see.



Unique photo - shows wetted soil-bed-wall. Usually growers are not able to see such sight. Israel 1976 Yoseph Shoub ©

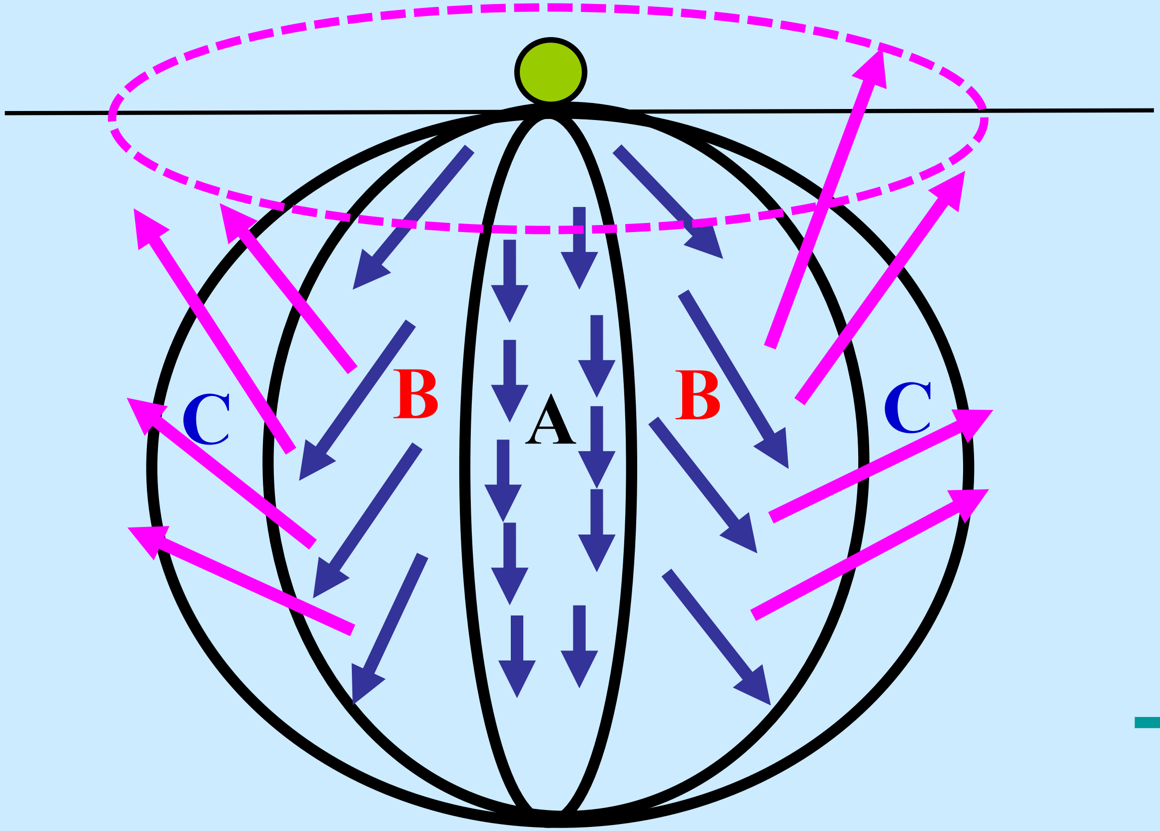
Shoub y. 2004, International Water & Irrigation, vol. 24, 4.



Olives, Israel, 2009. Salty-halo, resulted of excess fertilizer salts transported up to the soil surface.

SOIL MOISTURE - WETTING PATTERN

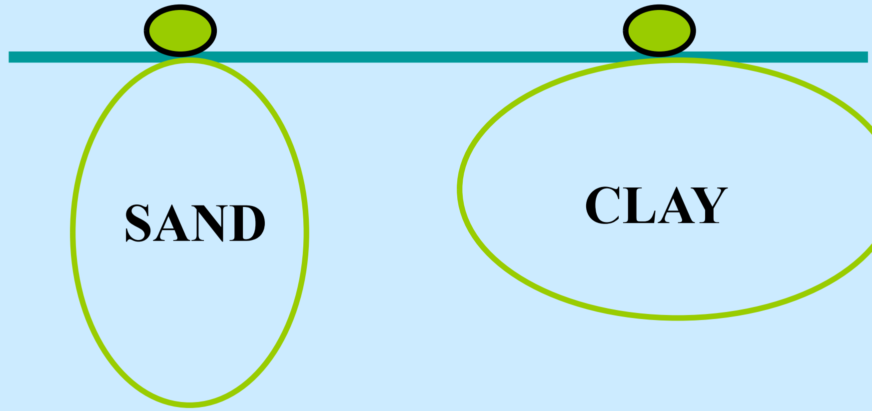
Graphic description shows the effect of gravity water movement followed by capillary movement, on the development of ‘wetted bulbs’, ‘salty fronts’ and ‘salty halos’.



A **Gravity movement**

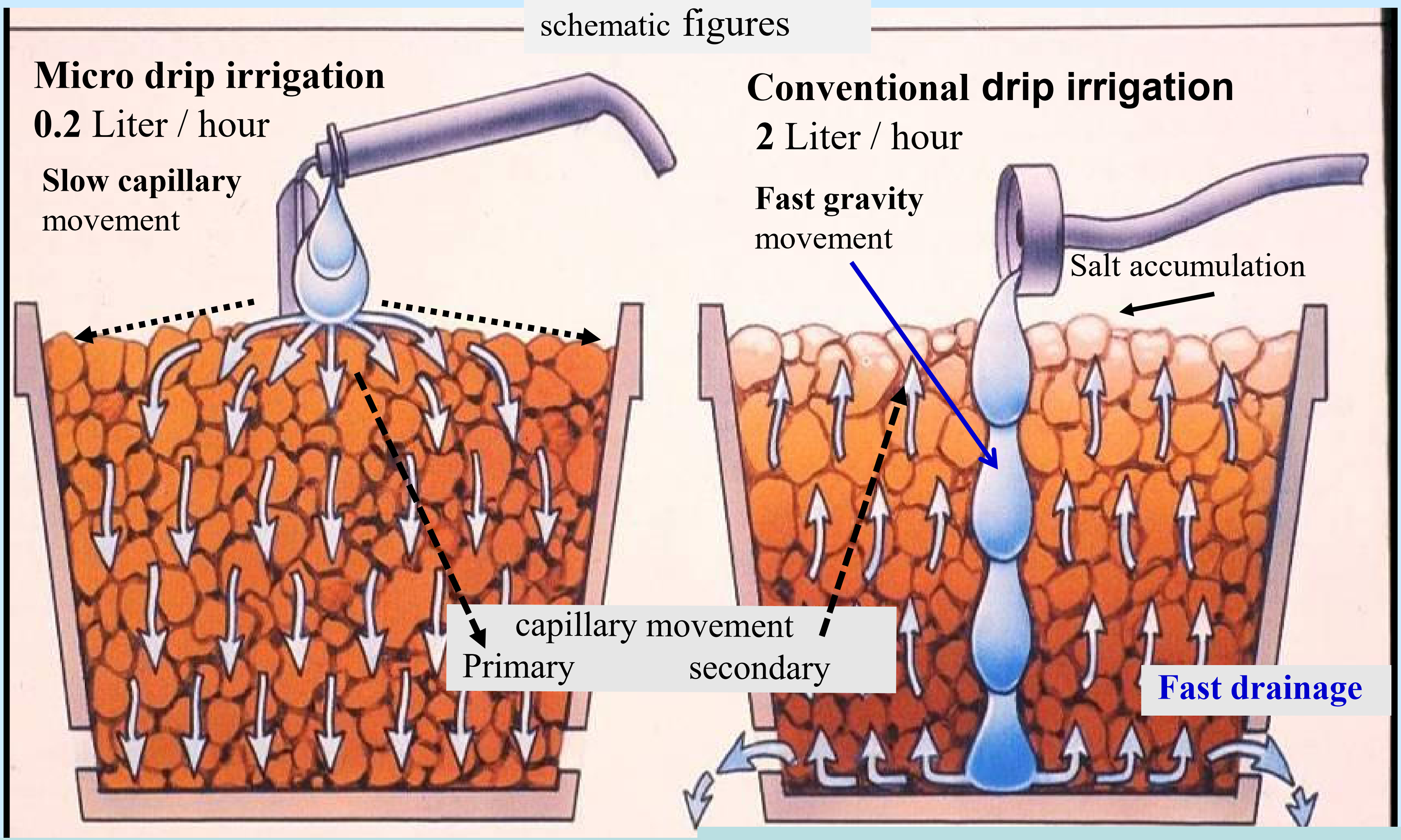
B **Gravity movement** & **Capillary movement**

C **Capillary movement**



Salty-halo in heavy soil, Ecuador 2005
Gypsophyla 4 weeks after planting.

Capillary movement versus Gravity movement in containers media.



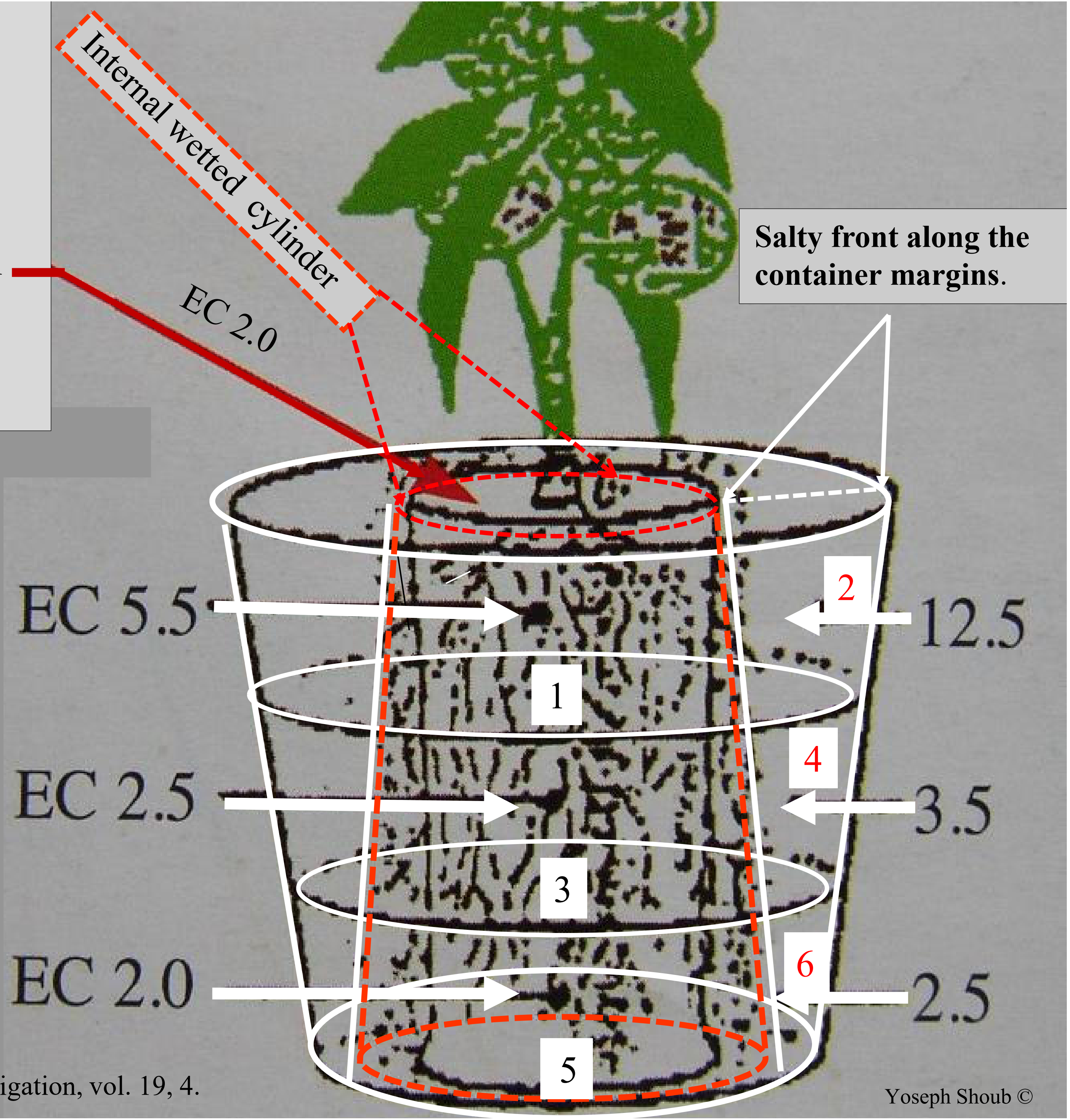
Shoub y. 2004, International Water & Irrigation, vol. 24, 4.

Micro drip irrigation - Creates **slow capillary** water movement through the entire root volume, and helps to avoid salinity damage.

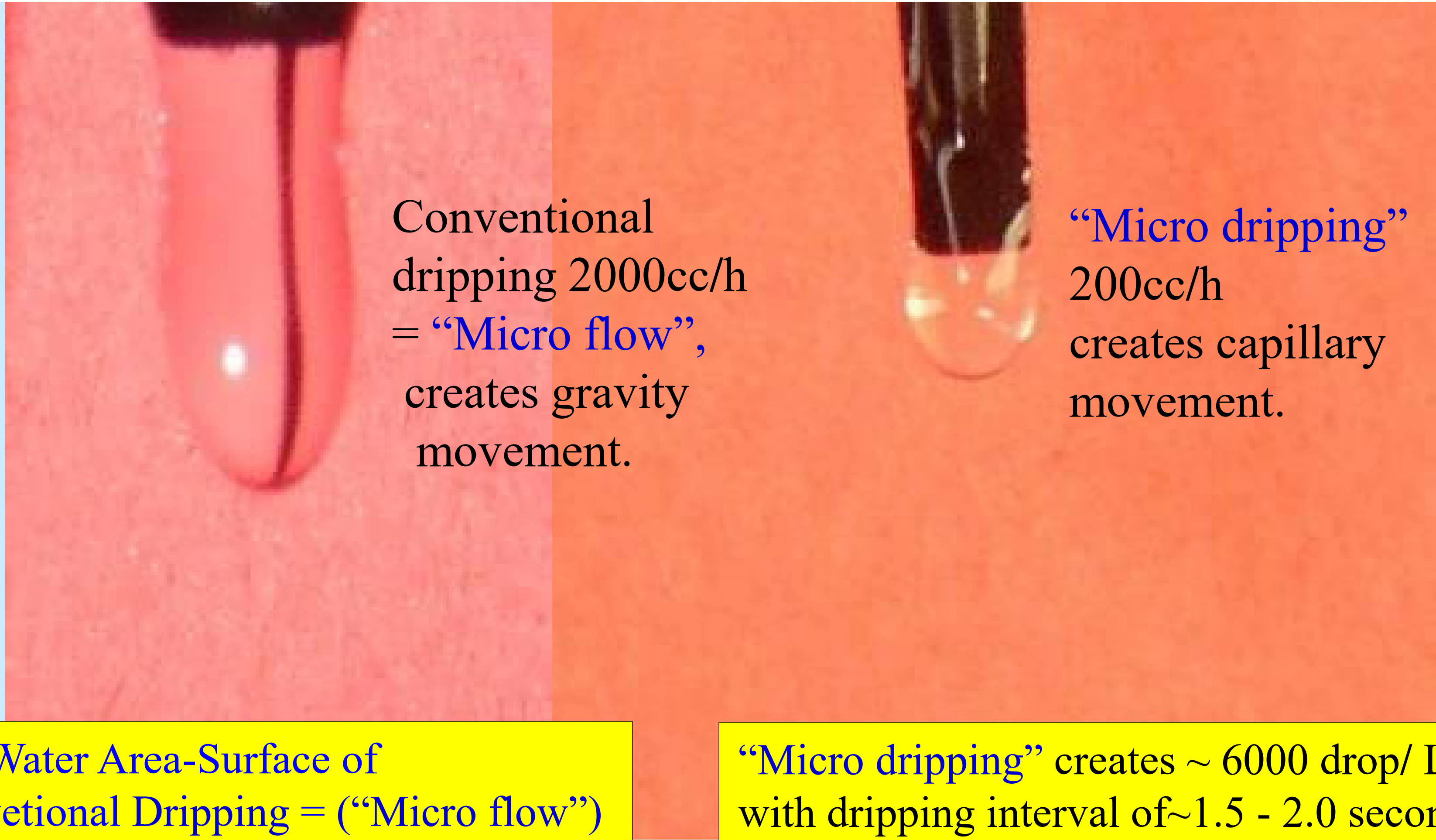
Conventional drip irrigation - Creates **fast gravity** movement and **fast drainage**, but at the same time promotes upward capillary movement of minerals = **'Salinity'.**

Salinity in inert media caused by 'gravity water movement' -

The effect of water-flow of 2 L/h on the EC in 6 sections of growing media, 6 weeks after planting gerbera plants.



Shoub y. 1999, International Water & Irrigation, vol. 19, 4.



The Water Area-Surface of Convetional Dripping = ("Micro flow") is relatively small. Therefore its permeability to oxygen is rather smaller than Micro dripping water area-surface.

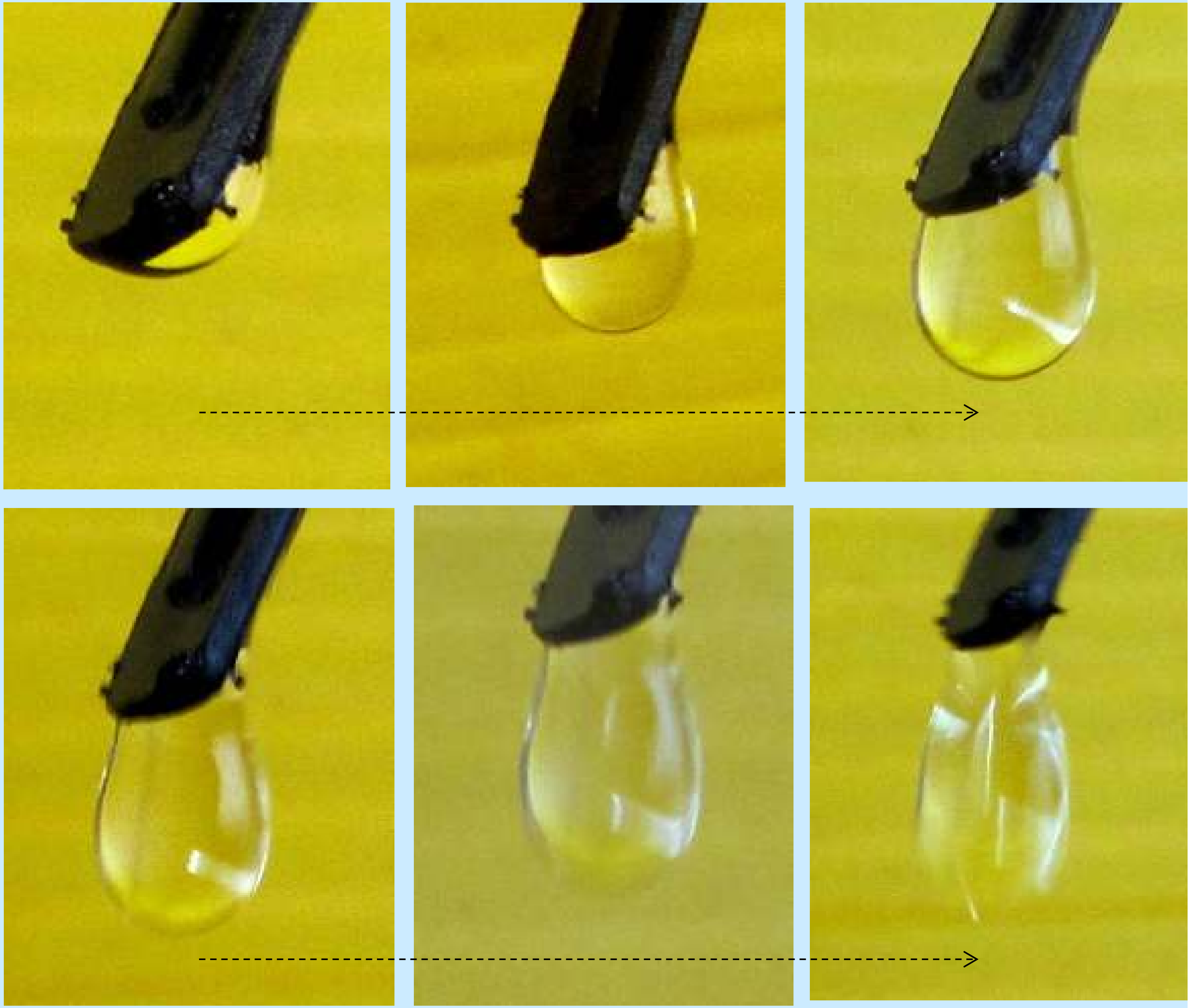
"Micro dripping" creates ~ 6000 drop/ Liter, with dripping interval of~1.5 - 2.0 seconds. Therefore the Area-Surface of the water is bigger. This fact increases and lightens the permeability of the oxygen into the water.

Born of a water drop, produced by micro irrigation system -

Its maximal volume will be ~ 0.166cc

The next drop will start to develop ~1 second later, and be released subsequently ~ 1 second later.

The small water volume and the slow water movement create the ideal capillary movement.



The capillary movement is the leading step towards ‘Sustainable Precision Agriculture’.

The ‘AA’ Tensiometer -
is a device that measures the ‘Water Tension’ in the soil.
The values measured are related to the amount of water presence in the soil/media.

-

While the water capacity is reduced, the water tension is increased.
And vise versa - when the water volume is increasing, the tension is reduced.

-

The ‘AA’ Electronic Tensiometer is utmost sensitive device.
It measures in solid media:
“Hydroponic conditions” values.

Definitions:

Constant Optimal growing condition for the secondary roots, can be considered

'Hydroponic conditions values in solid growing media' - on condition that the Optimal

ratios of Water/ Air/ Minerals, are continuously present in the roots media.

These optimal growing conditions, can be achieved for the secondary roots, only if the "Water Tension" in the growing roots' media is controlled daily 24 hours.
And this is exactly what the 'AA' systems are controlling accurately.

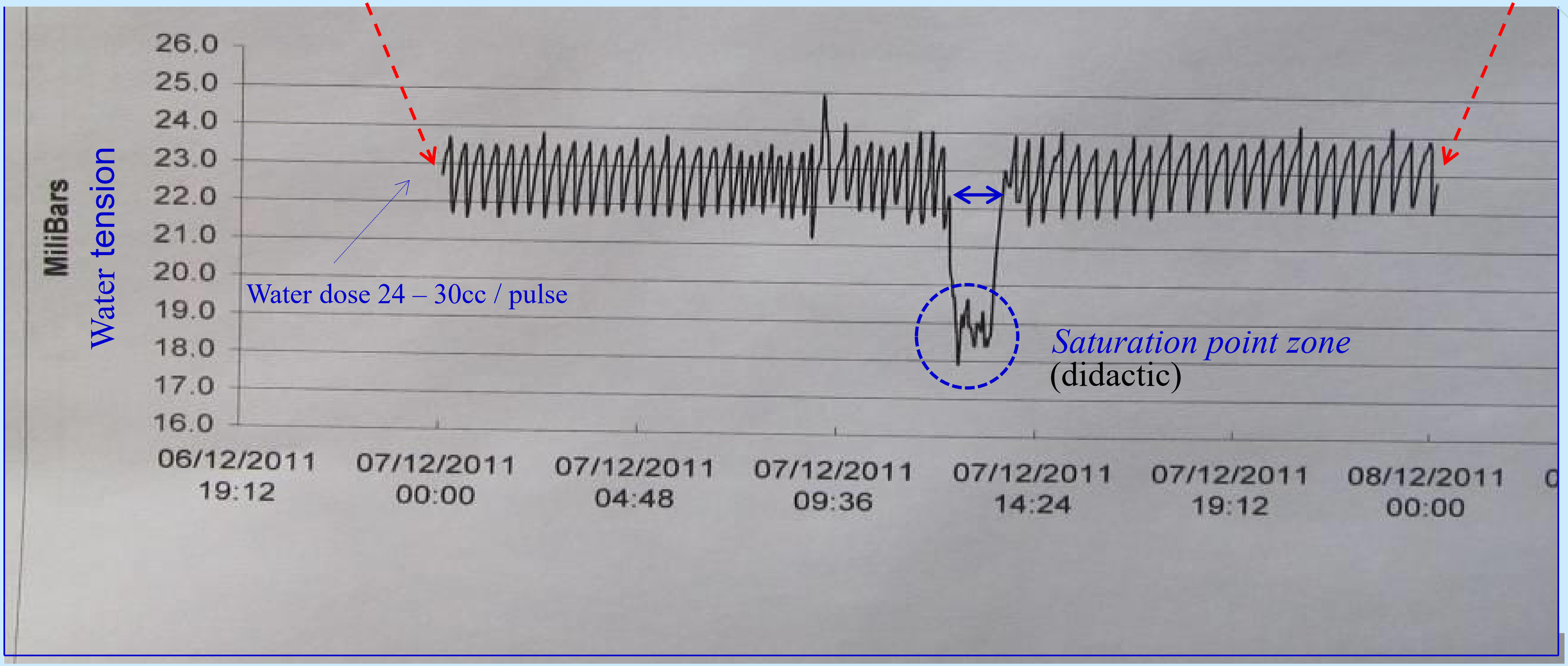
The adjusted optimal Water tension values are specific for a given media and character.

The Hydroponic conditions values are close to, but are above the 'Saturation-point'.

The Saturation point values; defined as water tension-values for a given wetted media, when all the capillary spaces in the soil / media are filled with water.

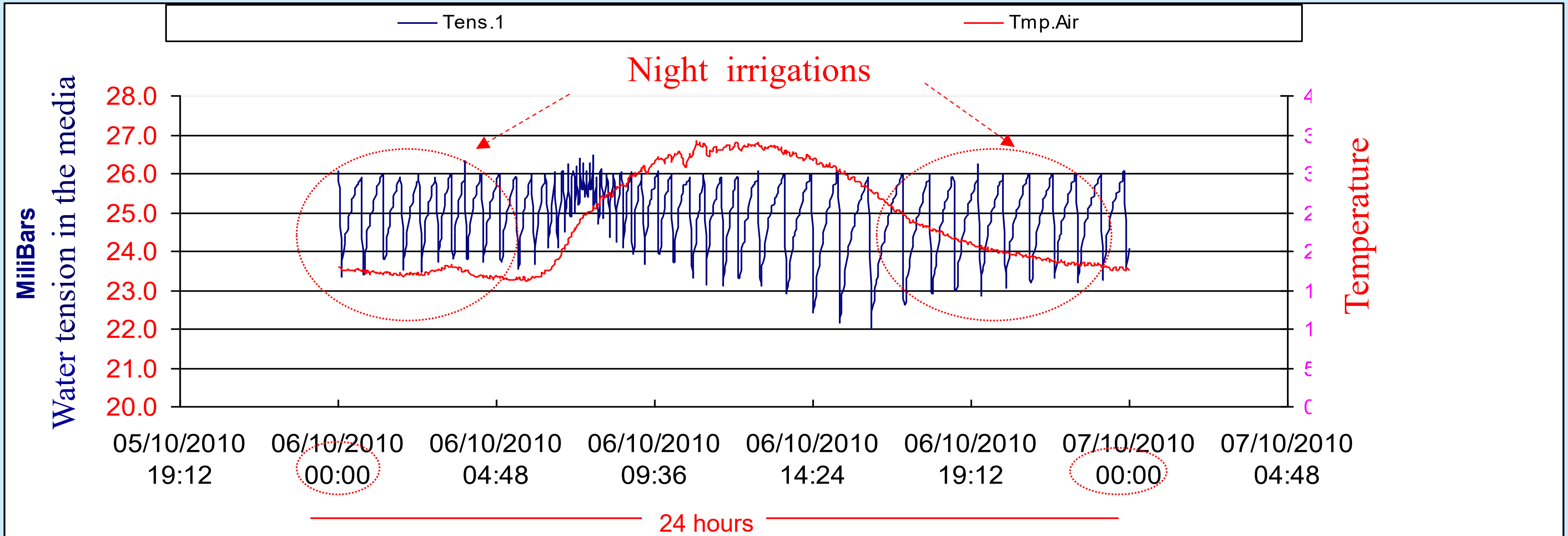
For example: the Hydroponic conditions in the coco-peat media used in the present experiment, was in the range between 24 to 21 millibar, and the 'Saturation point' was around 18 millibar.
(See the graph in the following page.) ↓

24h of Hydroponic conditions - 'Close to the Saturation point'



A didactic technical experiment; Saturation point conditions in coco-peat media, used for gerbera grown in containers. Both the Hydroponics conditions and the Saturation point where controlled by the 'AA' system. *Gerbera Breeding Ltd.* Israel 2011.

Water consumption at night -



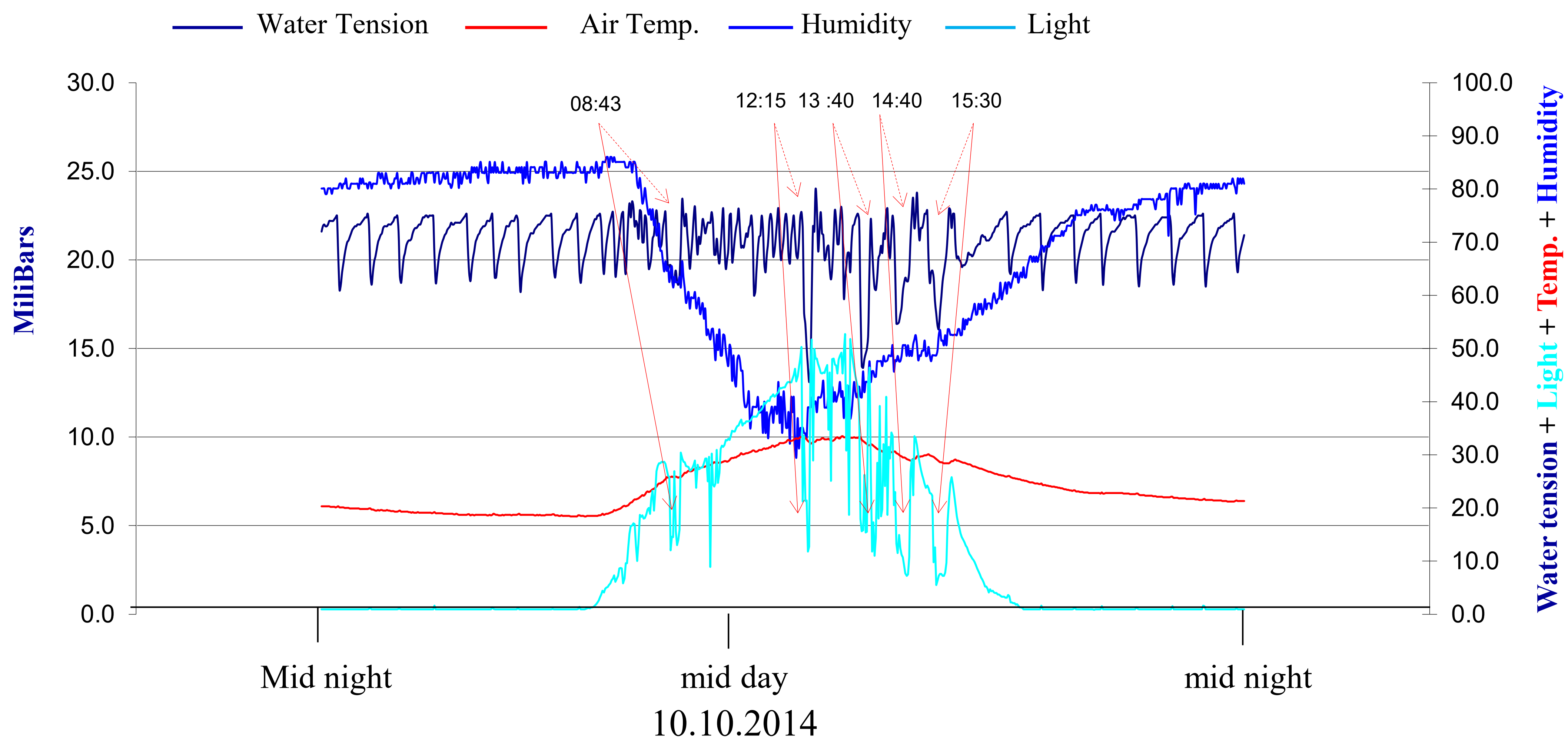
24 hours of water consumption by a mature gerbera plant, grown in a greenhouse in coco peat in 4 liter container, - on one October day.

AA' system identified water consumption throughout 24 hours of the plant activities.

On that day the 'AA' system responded by 23 night irrigations and 32 day irrigations.

The temperatures of the irrigated water during the winters-nights, are always higher than the air-Temp. it keep the roots media temperatures about 3 to 4C above the air temperatures in the greenhouse.

Water consumption of a gerbera plant as affected by the **light** and the temperatures



Water consumption at night -

The phenomenon of water consumption during the night was discovered by the ‘AA’ systems, in all the ‘AA’ controlled crops (over 100) *(see next slide)*

Therefore one can assume; that water consumption at night is an integral and the normal activity of intensive-crops, and we must not ignore it.*

The plants absorb the soil-solution at night, probably, for the available oxygen they need in it, and for the translocation of the photosyntates-products to all the plans’ organs.

***Surprisingly** on 2012 there wasn’t almost no information in the scientific literature regarding it.*

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* Regular Intensive Agriculture do not relate in practice to this night activity.
Therefore: we suggest to clarify this finding by an associated research.

List of ‘AA’ controlled Plants *(in greenhouses, in tunnels, and in open fields.)*

Flowers: Roses, Lilies, Gerbera, Adenium, Amaryllis, Carnations, cyclamens, Geraniums, Tagetes, Zinnias, Ginger, Canna, Bird of paradise, Ferns.

Vegetables: Tomatoes, Egg-plants, Cucumbers, Spinach, Celery, Beet, Chives, Kohlrabi, Beans, Spring onion, Pepper, Cauliflower, Cabbage, Carrot, Lettuce, Broccoli, Fennel, Kale, Parsley, Peas.

Field crops: Corn, Wheat, Potatoes, Melon, Cotton, Pumpkin, Ananas.

Spicing plants: Basil, Mint, Rosemary, Sage, Coriandrum, Thyme, Cannabis.

Berries: Strawberries, Blackberries.

Fruit trees: Olives, Lemon, Figs, Apple, Grapes, Avocado Guava, Papaya, Banana.

Forestry trees: Oaks (3 species), Pines (3 species), Cedar, Carob.

Gardening plants: Trees & Bushes, Ornamentals, Botanical species and others.


Aquifers Contamination Risks can be avoided -
Winter crops greenhouses -
Faran, Middle-Arava *(Prairie)*, Israel, Dec. 2012
In one of these greenhouses, 'AA' controlled Pepper, was compared -
Versus - Pepper under the Common programed a head method.
September 2012 – April 2013
Yoseph Shoub ©

Fertilizers' excess - a potential source for contaminating the Arava aquifer.

Pepper under AutoAgronom - versus - Programed a head irrigation.

Faran, Middle-Arava, Israel (Sep.2012 - April 2013).

Pepper under program a head Fertigation: Yielded **95** ton / hectares

Water - **42 cu/day/hectares = 10,000 cu./season (Sep. – April).**

Liquid-fertilizer - **1.5Liter/1cub = 15,000 Liter/Season = 7.5 ton solid fertilizers/ hectare.**

Pepper under 'AA' control: Yielded **98** ton/hectares

Water - **22 cu./day/ hectares = 5,300 cu/season (53% versus the common program**).

Solid-fertilizer = **about 1.15 ton/Season/hectares (15%) = 6.35 ton difference.**

Economic comparison between the Common Method versus the 'AA' Method.

Evaluated input figures for **3,000** Hectares of Pepper in the Arava (prairie area) -

Yearly water supply **30 million cu. And 14 million** cu. 47% **Out of it is surplus.**

Yearly fertilizers supply: **22.500 ton; 19.000** ton (84%) **Out of it** washed into the Arava-
- aquifer.

Yield: Both the 'AA', and the conventional programmed plots produced the same yield

and quality of pepper .

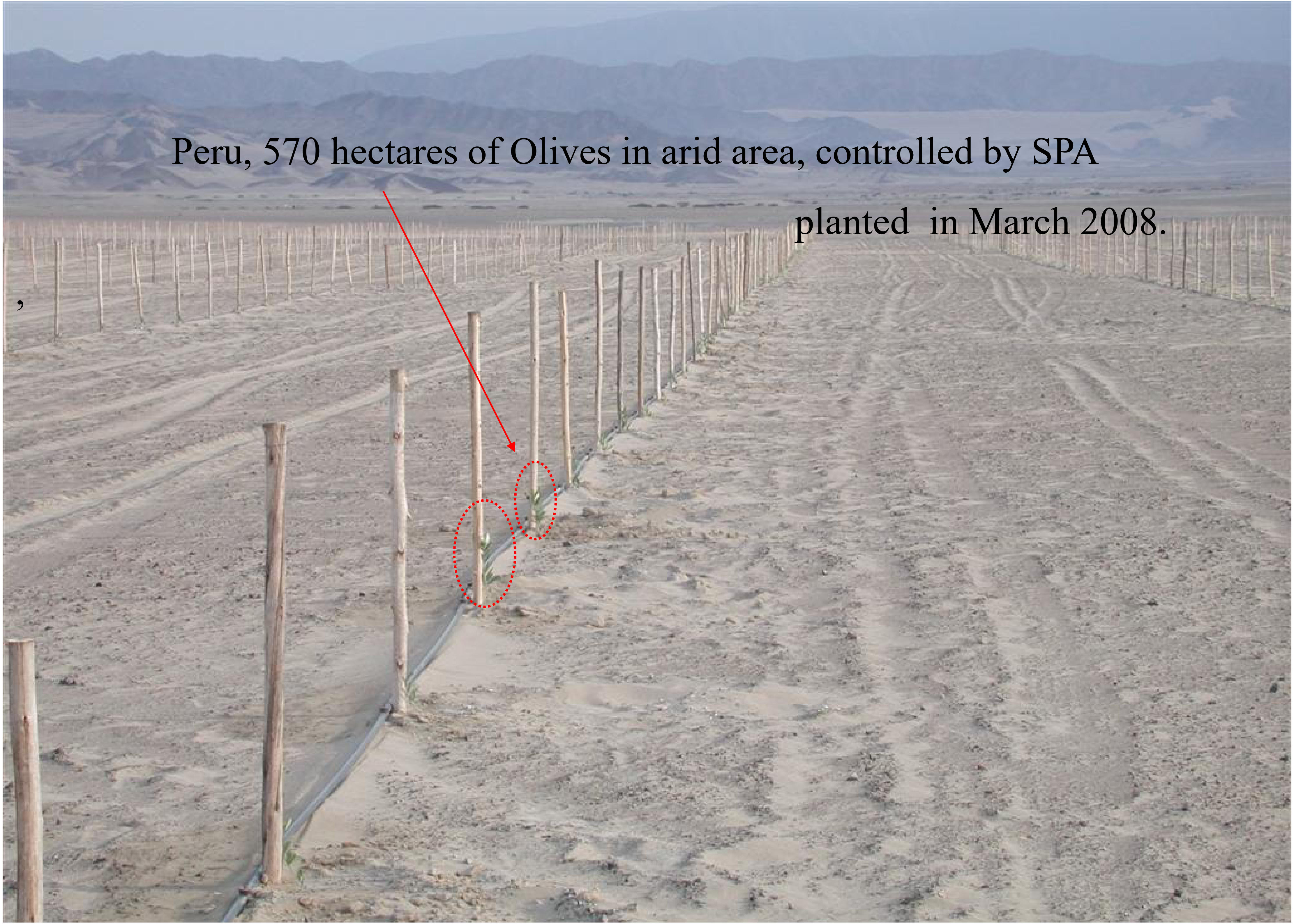
Can we accept that every year, **19,000 tons** of fertilizers are washed by **14 million cu. water below the 3,000 Hectares** of intensive agriculture, contaminating the Arava aquifer, **and all are paid by the growers ???**

Epilogue –
Agro-technology companies and agricultural scientists, have been trying persistency to find a link between the plant's activities and the irrigation control systems. However; despite our computerized era with its achievements, the proposed solutions up to now have been not friendly to the plants and the growers.

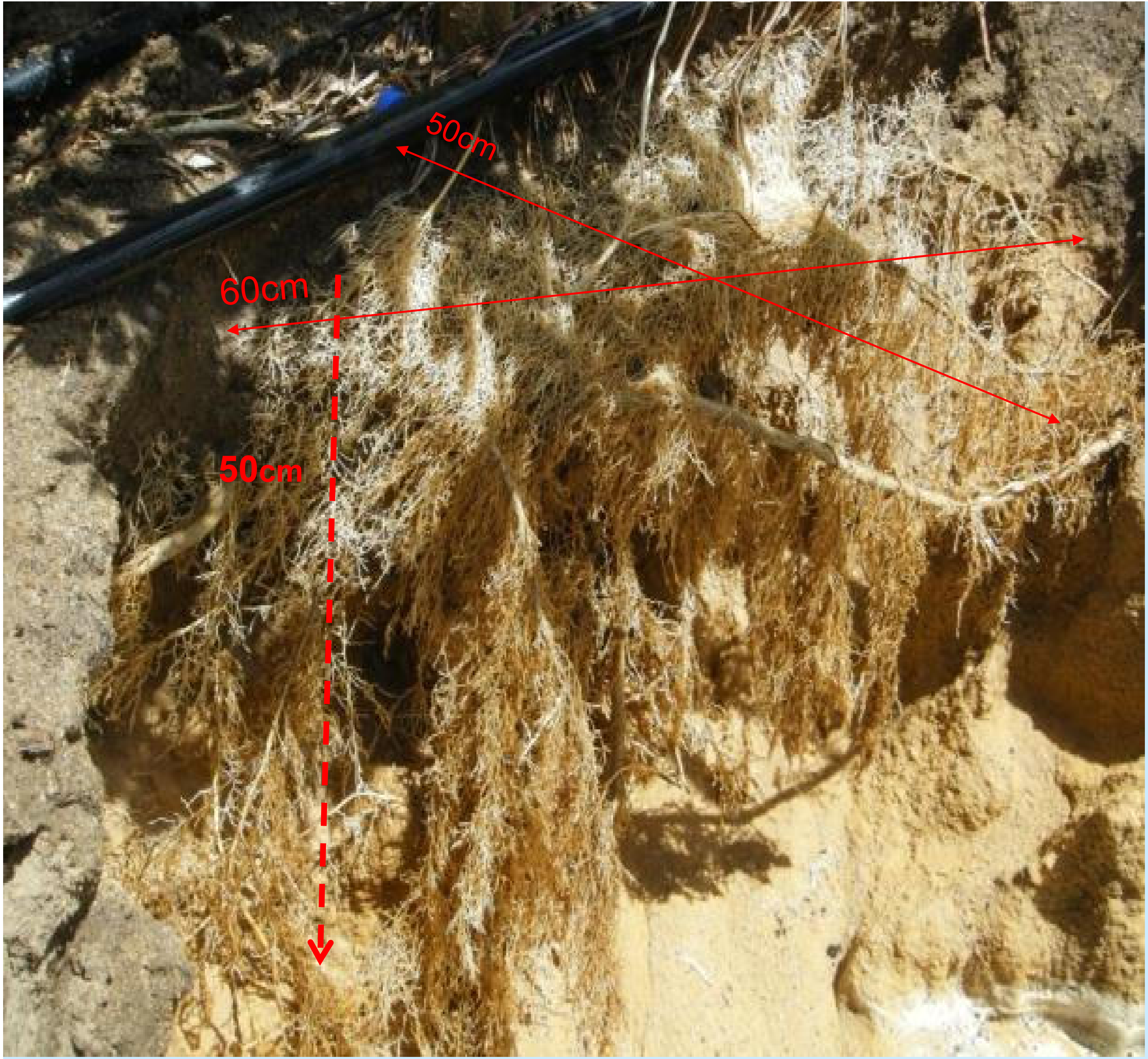
The AutoAgronom concept and its practical solutions represents the essential change intended for intensive agriculture, and it work efficiently well.

It is not a technical change, it is a different attitude for benefiting the plants production potential by serving the plant activities on real time, when water oxygen & minerals are really needed.
In crops, where the 'AA' method was implemented, the environmental conditions have changed for the better, while production-factors have become more efficient**:**
In water use, oxygen availability, and of nutrients absorption.

- Water have been saved (up to 50%), and fertilizer use was reduced to 15% -25%.
- Soil washing is eliminated and the aquifers contamination is prevented.
- Yields have considerably increased both in quantity and in quality.


Peru, 570 hectares of Olives in arid area, controlled by SPA
planted in March 2008.


Same olives trees one year after planting May 2009,
and their roots on July 2010.



Roots of 3 years old 'AA' Citrus tree,

in a form of

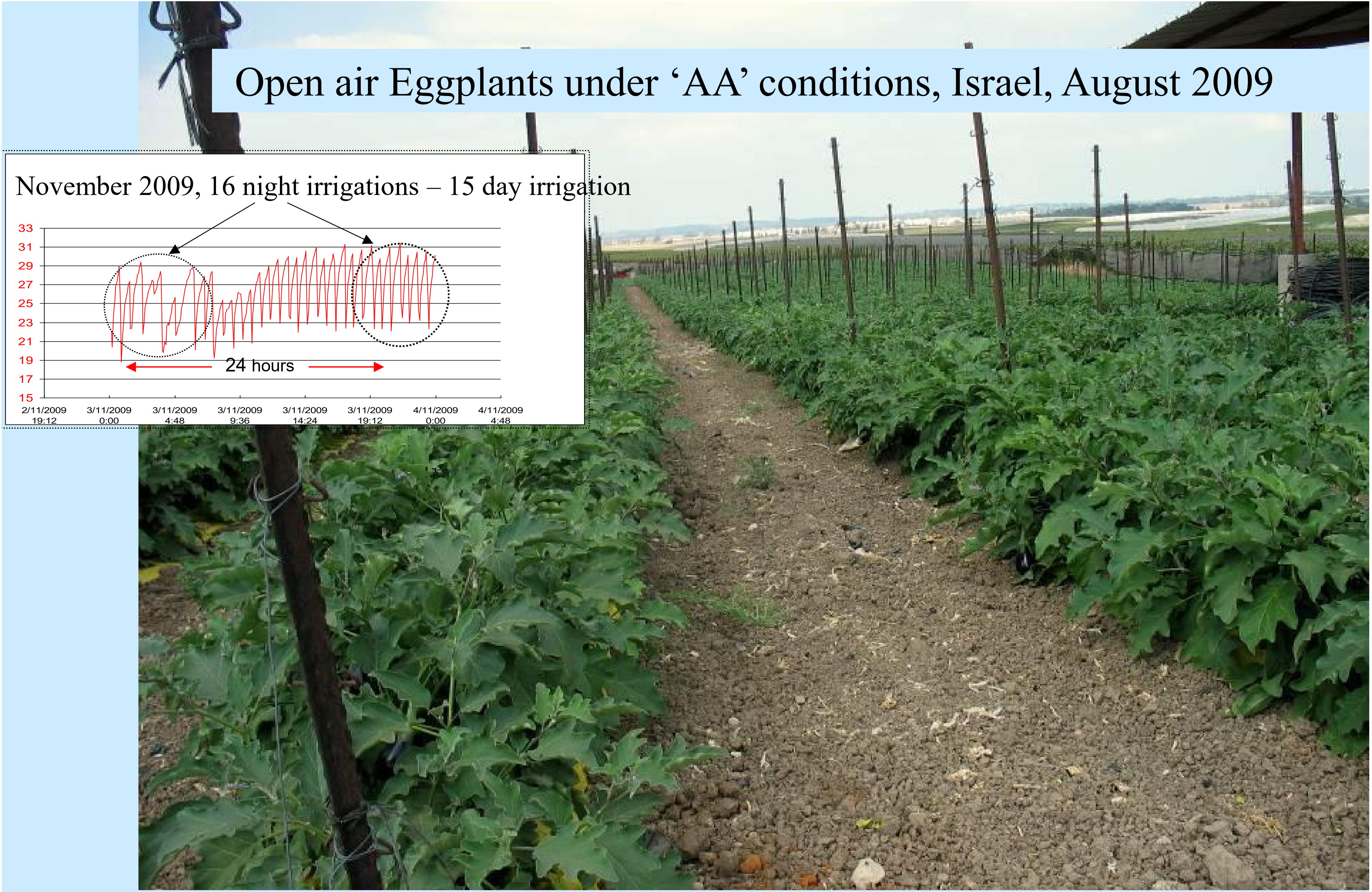
'Soil-container'
~15 liter of sandy soil.
Australia

January 2010.

Greenhouse Cherry Tomatoes under ‘AA’ control August 2009, Israel.

12.000 L/Hectare/day vesus. 50.000 L officially recommended to the growers.

Open air Eggplants under ‘AA’ conditions, Israel, August 2009



12,000 L. / hectare / day vs. 60,000 L. as recommended to the growers.

Cucumbers in greenhouse under ‘AA’ conditions, Israel, August 2009

Cucumbers’ production-efficiency: Common program - Versus ‘AA’ method *

* Report of the Israeli Ministry of Agriculture 2012.

Irrigation system

	Common	A A’	
Production efficiency	Cucumber weight		Difference %
per 1,000 L. water	26.3 kg.	41.3 kg	157
per 1 L. fertilizer	16.5 kg	36.8 kg	223

Wise Agriculture will win !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