Gerbera - Practice & Theory

Selected chapters

Morphology

Salinity

Fertigation

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Introduction

Modern gerbera varieties produce many flowers of high quality and do so in many different countries under different climate conditions. To achieve the production-potential and the quality-potential of the new varieties it is essential to create optimal growing conditions in the greenhouse.

For example, for gerbera and other intensive flower crops the environment in Colombia is optimal, as in this wonderful morning in the Rionegro area.


However;
Achieving the optimal growing conditions also depends on the know-how of the farm agronomist and on the farm management policy. We offer our knowledge and experience to our clients wherever they are.


Rodrigo in containers 4 months after planting, Colombia, March 2004
Our varieties are marketed world-wide solely by Selecta Cut Flowers s.a.u.

Marinilla in light-soil-beds 100 days after planting
Israel, November 2007

The morphology of the gerbera

The root system –

The roots are the most important organ of the plant as they absorb and supply water, oxygen and other minerals continuously over 24 hours.

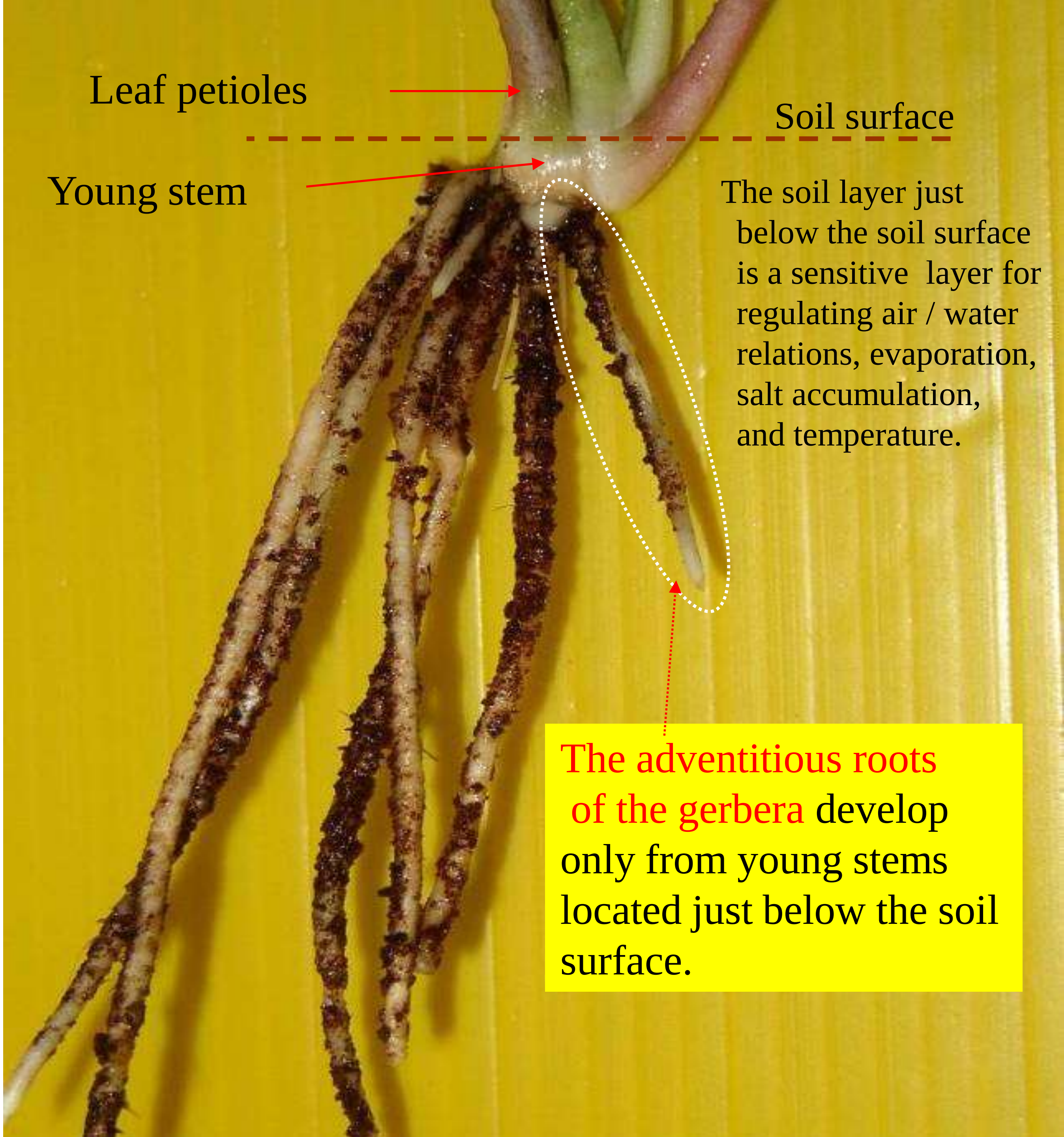
The gerbera root system includes:

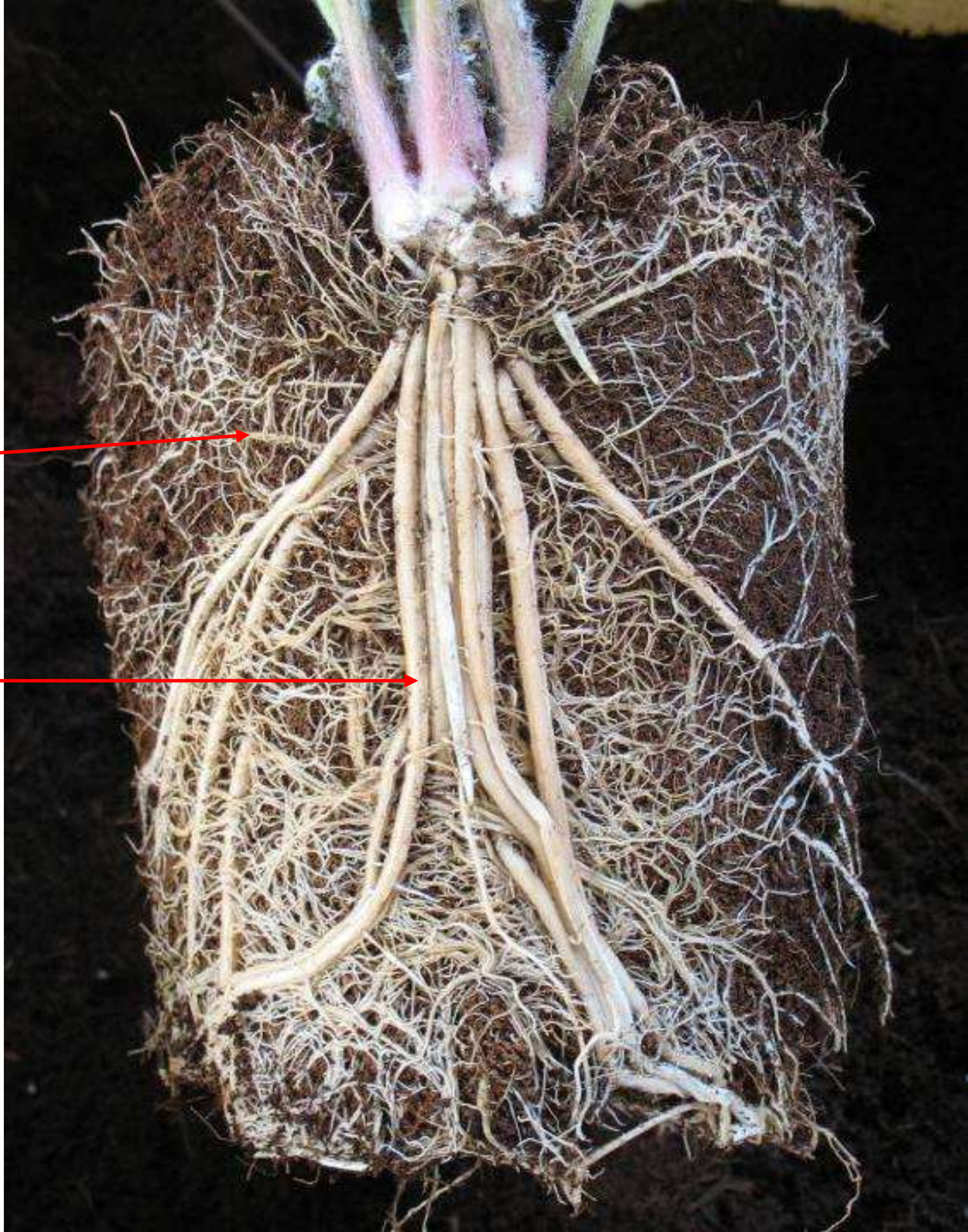
The adventitious roots,

and the secondary roots: the fibrous roots, root tips, and the root hairs.

Young gerbera stem and its adventitious roots.

(adventitious roots are not primary roots).





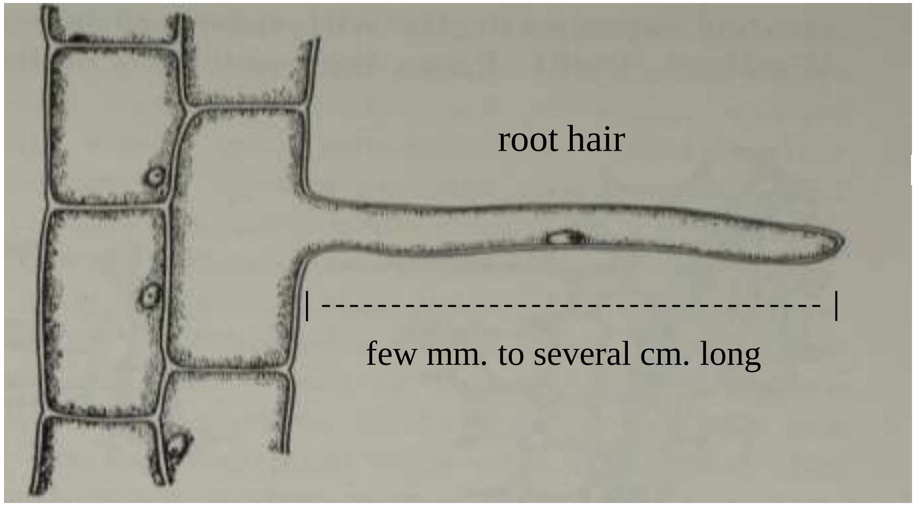
The secondary gerbera roots grow from the adventitious roots

Adventitious roots

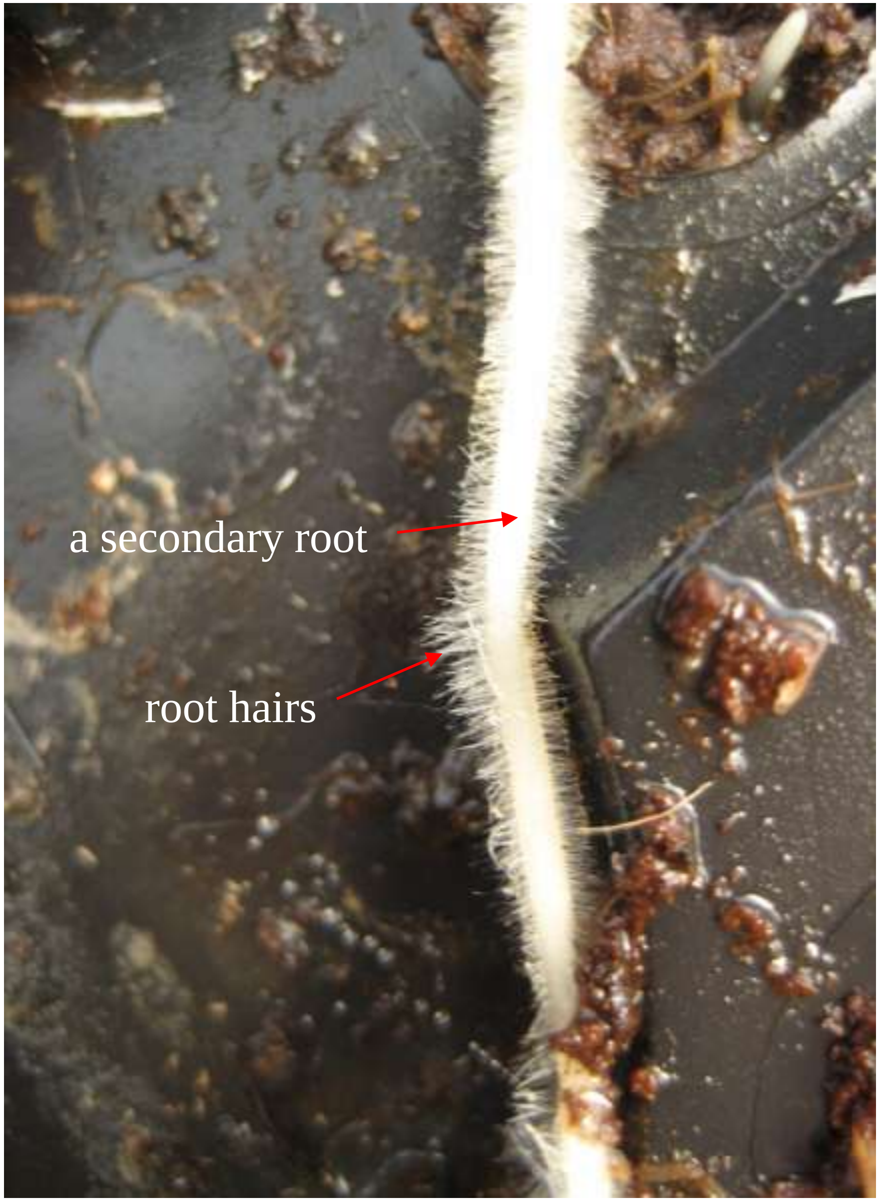
Root system of a gerbera seedling, grown in coco fibers, in 4L container.

The root hairs

The root hairs are epidermis cells of the secondary roots.
Their function is to absorb and transport water, oxygen and minerals to the productive organs of the plants.



Scheme of external cell-layer of a secondary root.

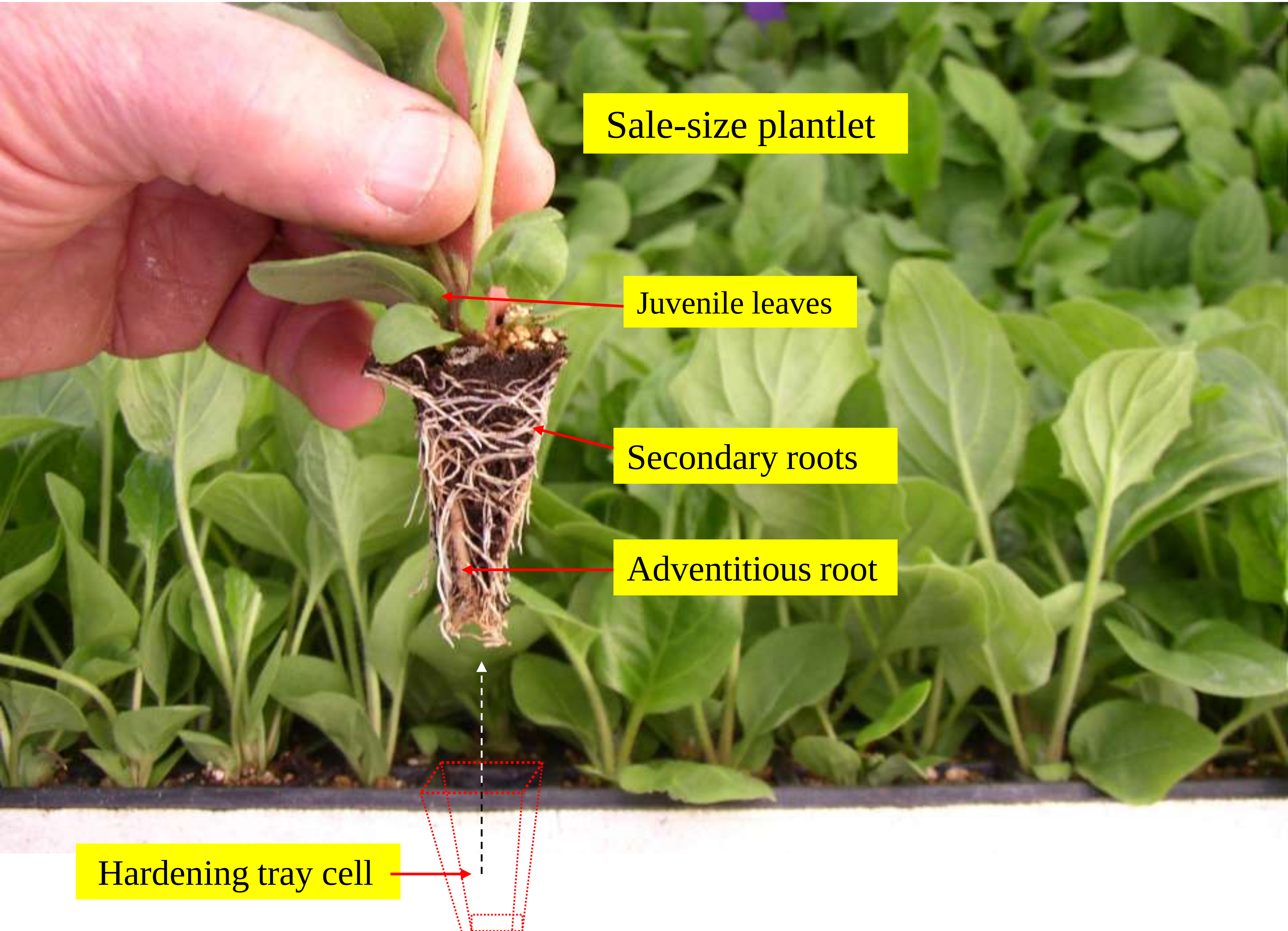


Root hairs of an apple seedling controlled by AutoAgronom December 2010

Absorption of water:

Water containing oxygen and minerals is absorbed by the plant only via the root hairs and the root tips.

Secondary gerbera roots inside the container

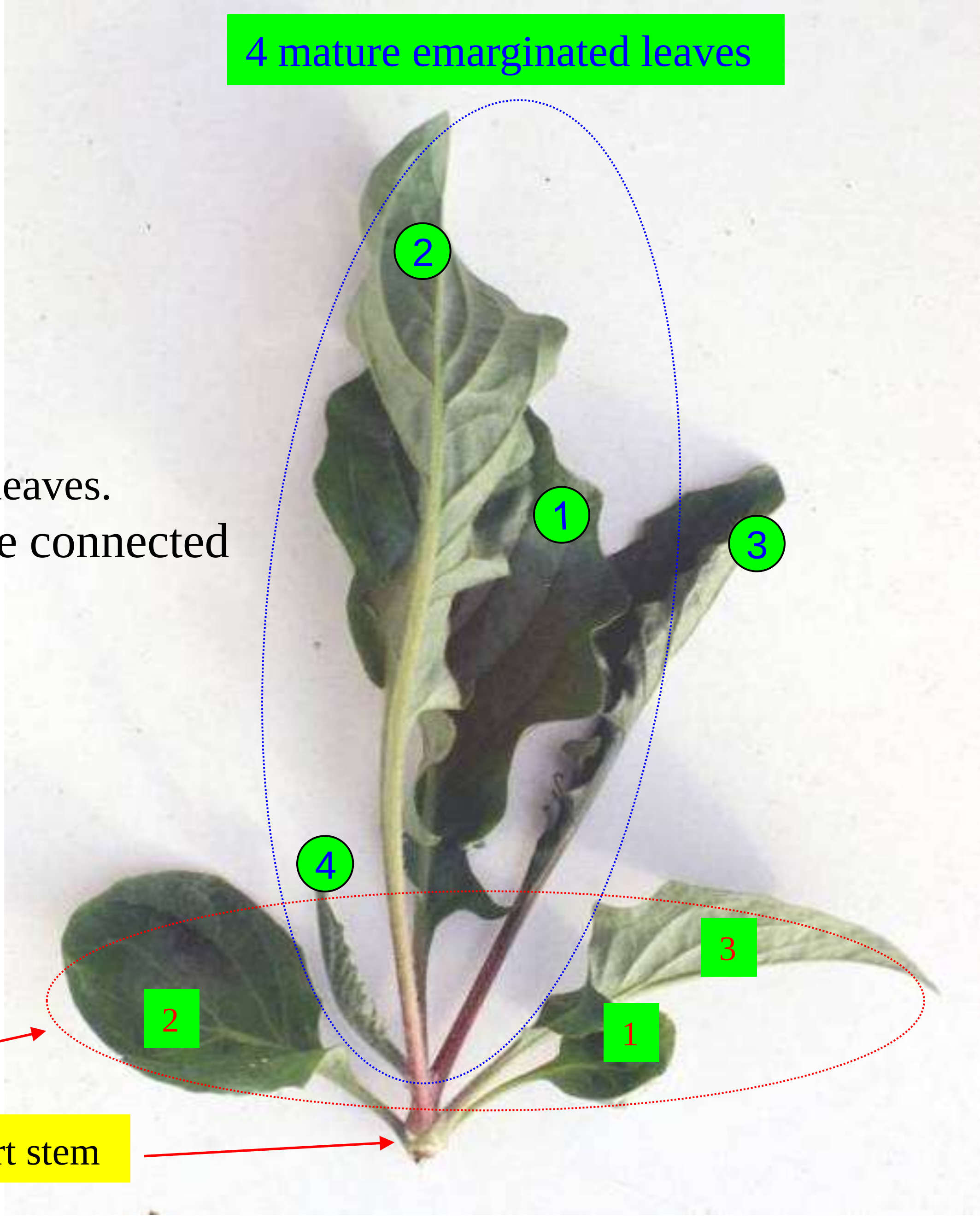

Sale-size plantlet
Juvenile leaves
Secondary roots
Adventitious root
Hardening tray cell

Young gerbera plants in raised organic soil, Colombia.

Gerbera root system in soil, Ecuador.
The secondary gerbera roots are active at a soil depth of 0 to 25cm.

The leaves

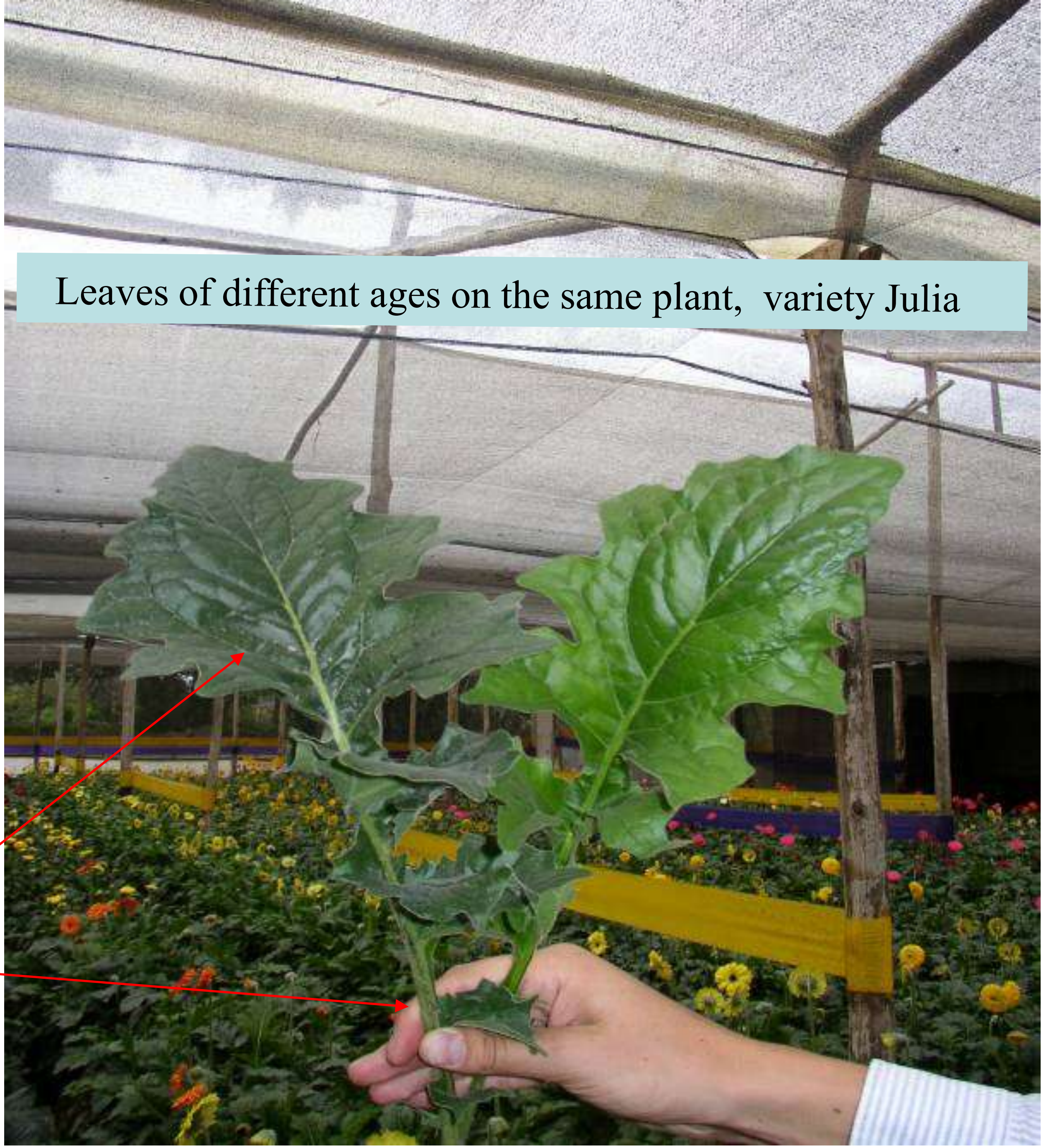
A gerbera stem carries only 4 mature leaves.
The emarginated mature leaves are connected to a short stem 3 to 5mm long.



3 round juvenile leaves

Young short stem

Round juvenile leaves are present only on sprouting seedlings and on laboratory plantlets.

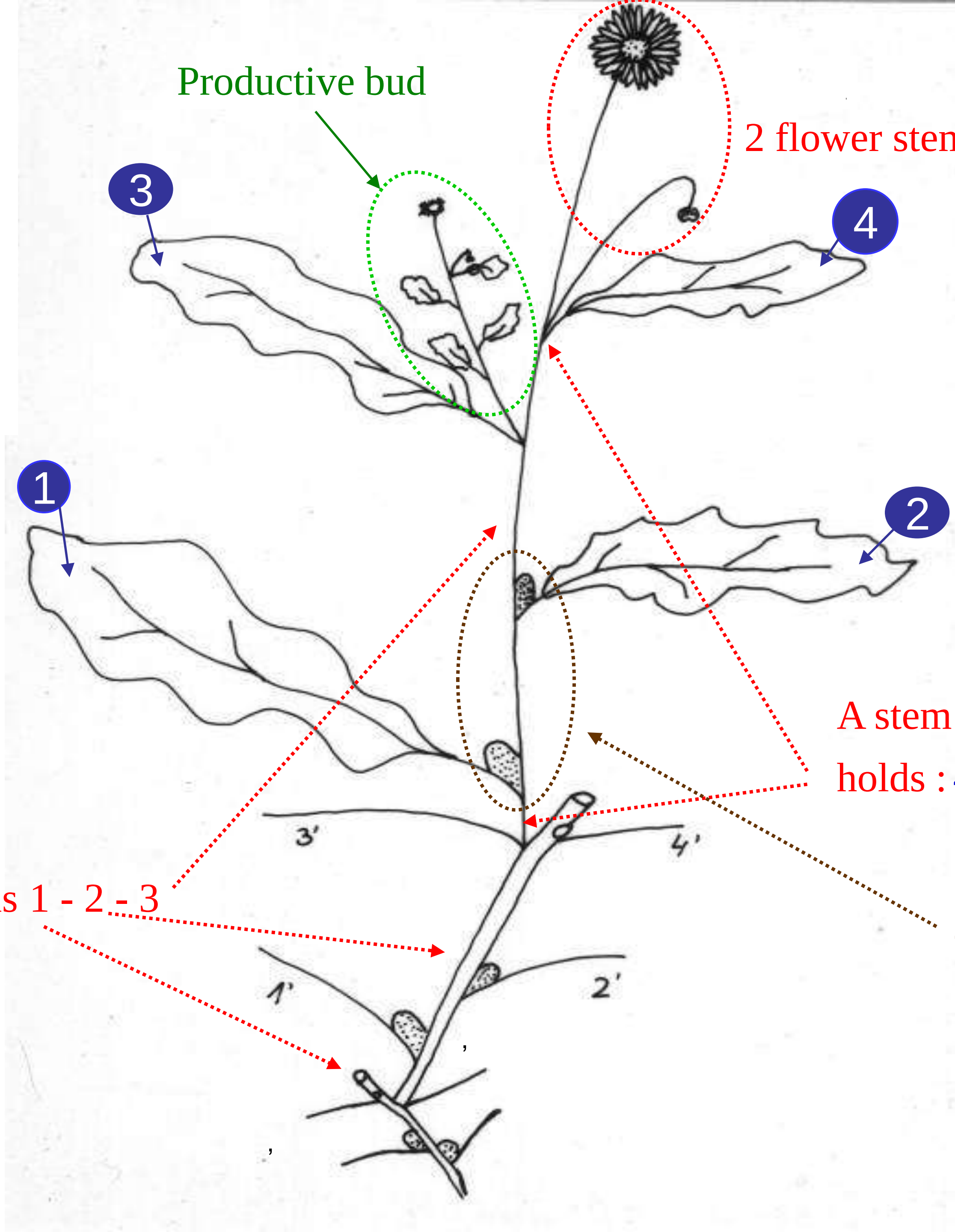


The leaf blade

The petiole


Active leaf
Older leaf
Better to remove the non-active old leaves

The branches



Scheme of a branch composed of 3 stems 1 - 2 - 3

The crown and the roots

The gerbera **c**rown
is composed of crowded,
compressed branches.

Adventitious root

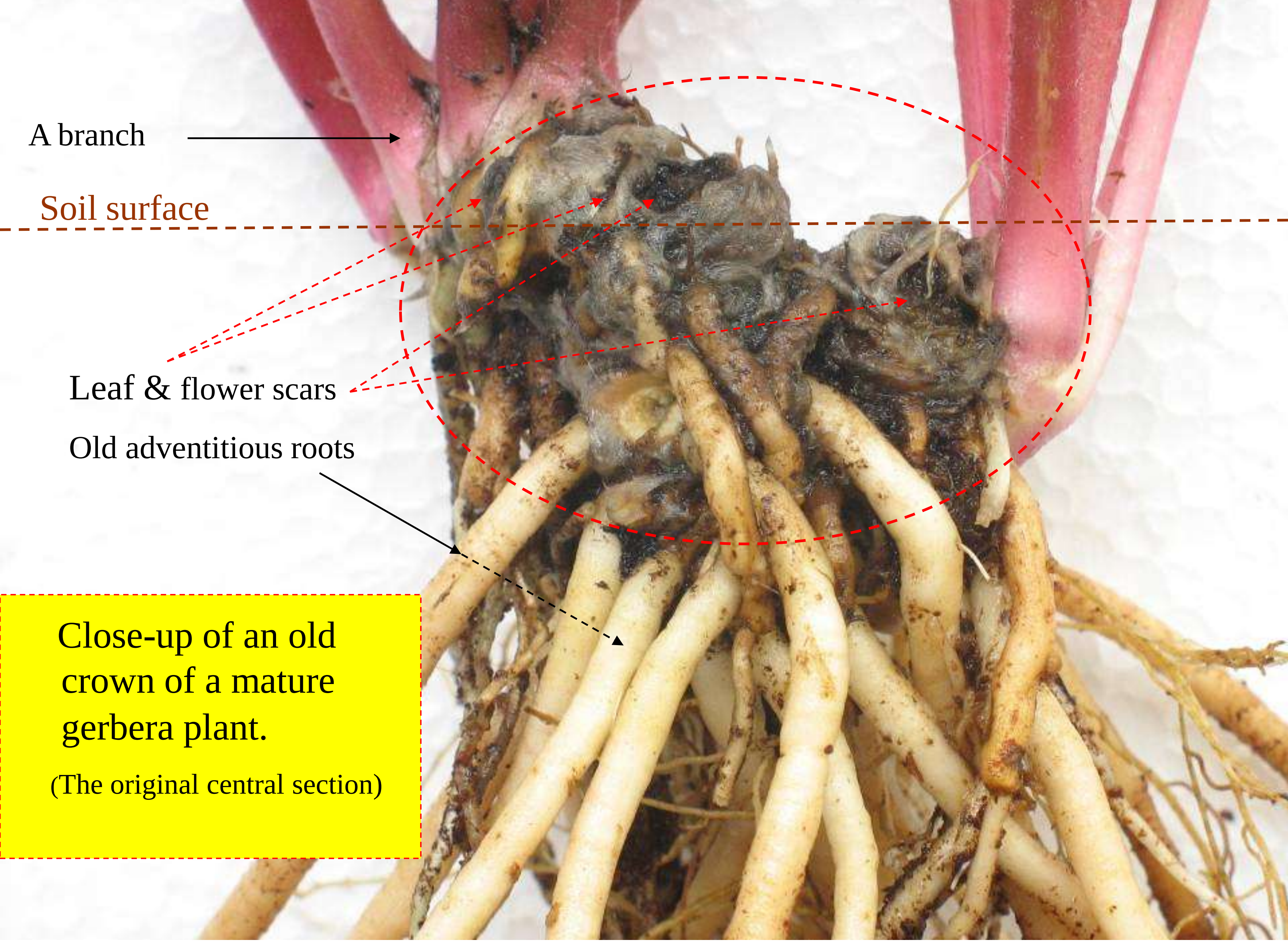
Secondary roots

Root system of 2.5-year-old gerbera plant developed in coco fibers in 4 liter container.

Left: actual situation

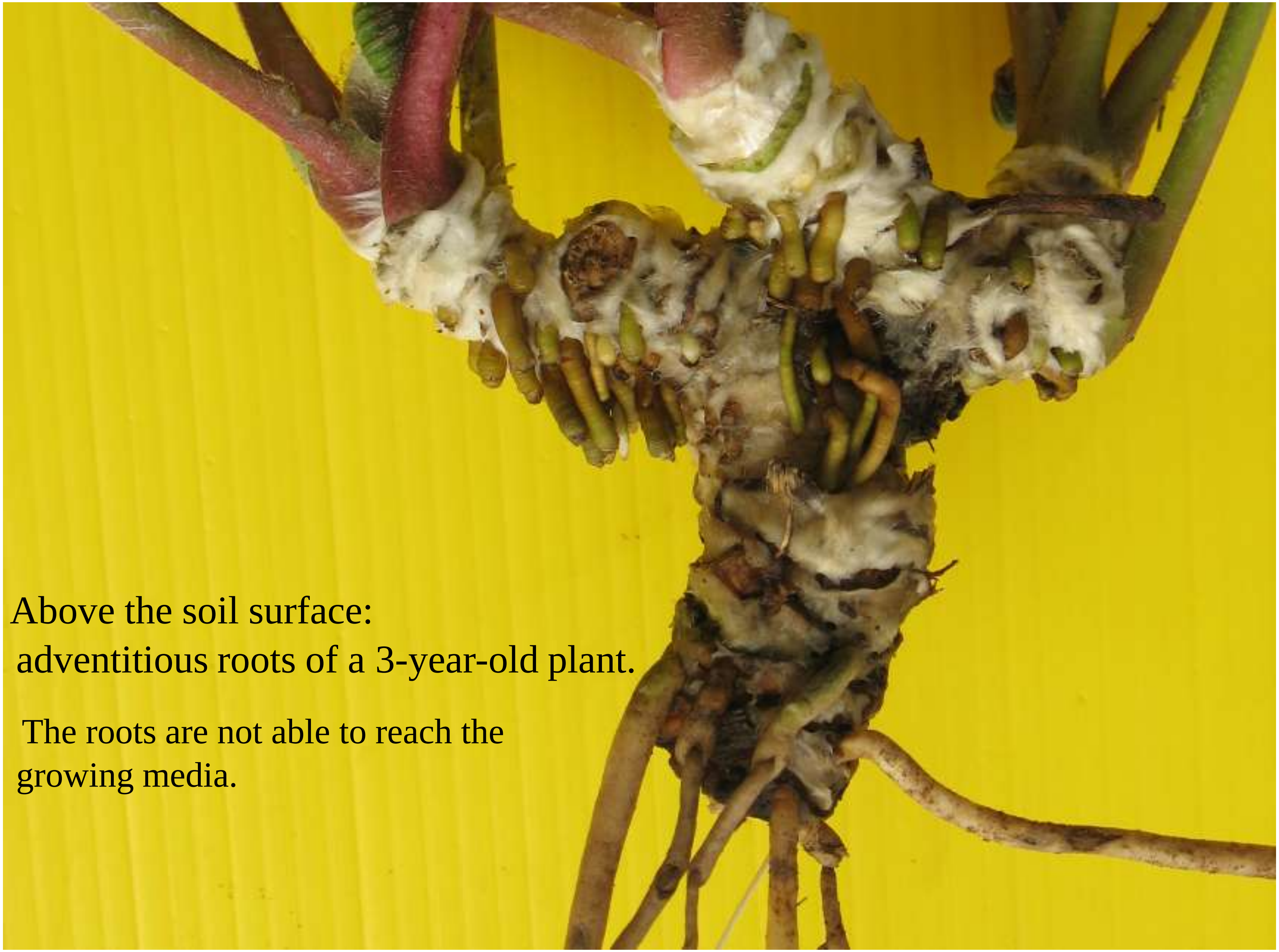
Right: washed out

Separated sections of the above mature gerbera plant.



Close-up of an old crown of a mature gerbera plant.

(The original central section)


Above the soil surface:
adventitious roots of a 3-year-old plant.
The roots are not able to reach the
growing media.

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An ‘old’ split-up gerbera plant, Colombia.

Growth & development

The gerbera is a
'self inductive plant'.

Blooming is not affected by day length or temperature.

Gerbera seedling under optimal growing conditions 6 weeks after planting already has 2 flowers and a new stem.

10 weeks after planting gerbera seedling already has more than 2 stems.

Under the ‘AutoAgronom’ irrigation control system it is possible to grow more than 1 seedling in a container of 4 liters.

The flower bud and the flower stem

Flower bud (5-7 mm)
as first_seen between the petioles.

At this phase the stem is not visible.

Stem elongation

The elongation starts
from the base of the stem.

The elongation process is not symmetric.

One side grows and elongates faster than the other side.

This growth pattern directs the flower-head* downwards.

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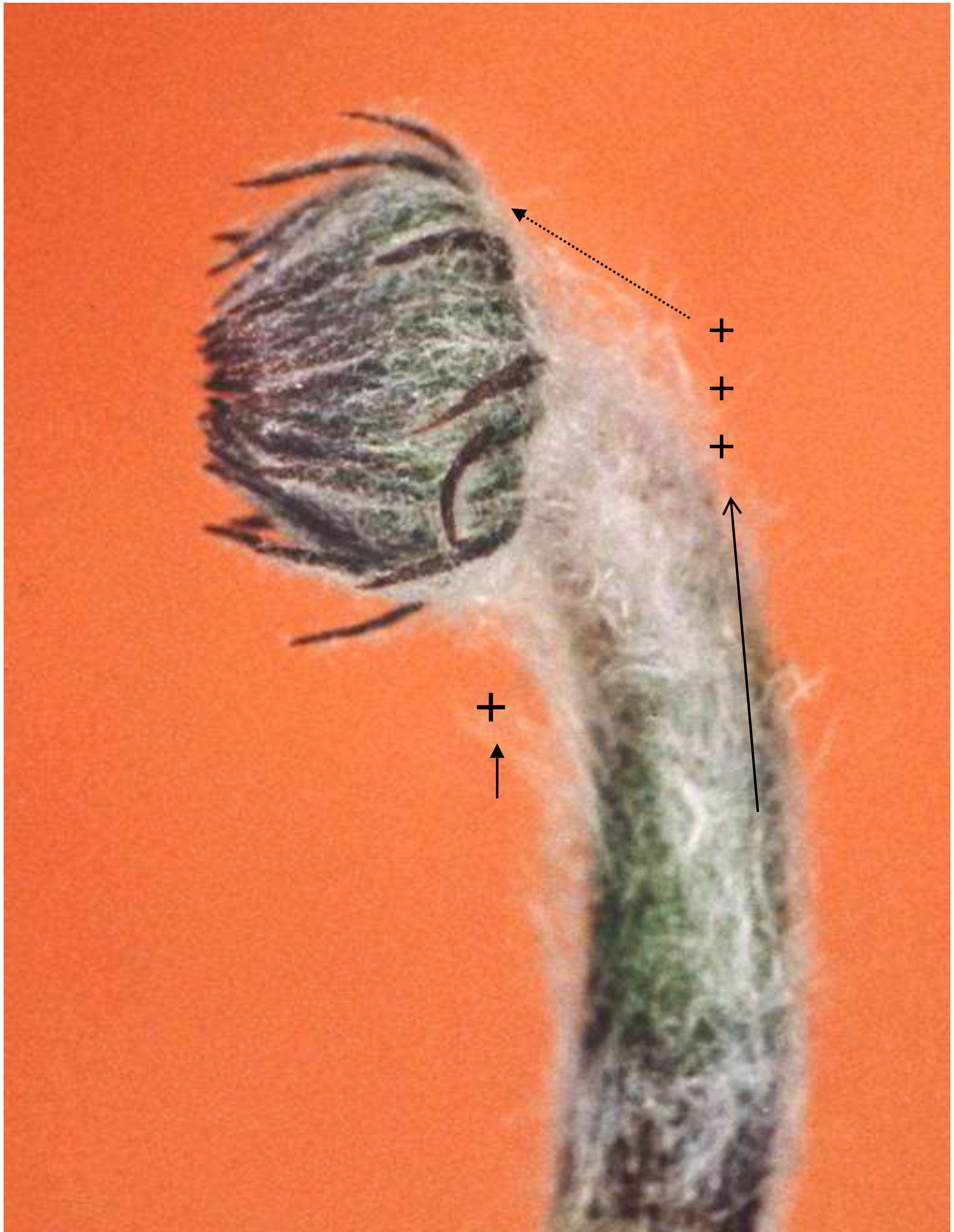
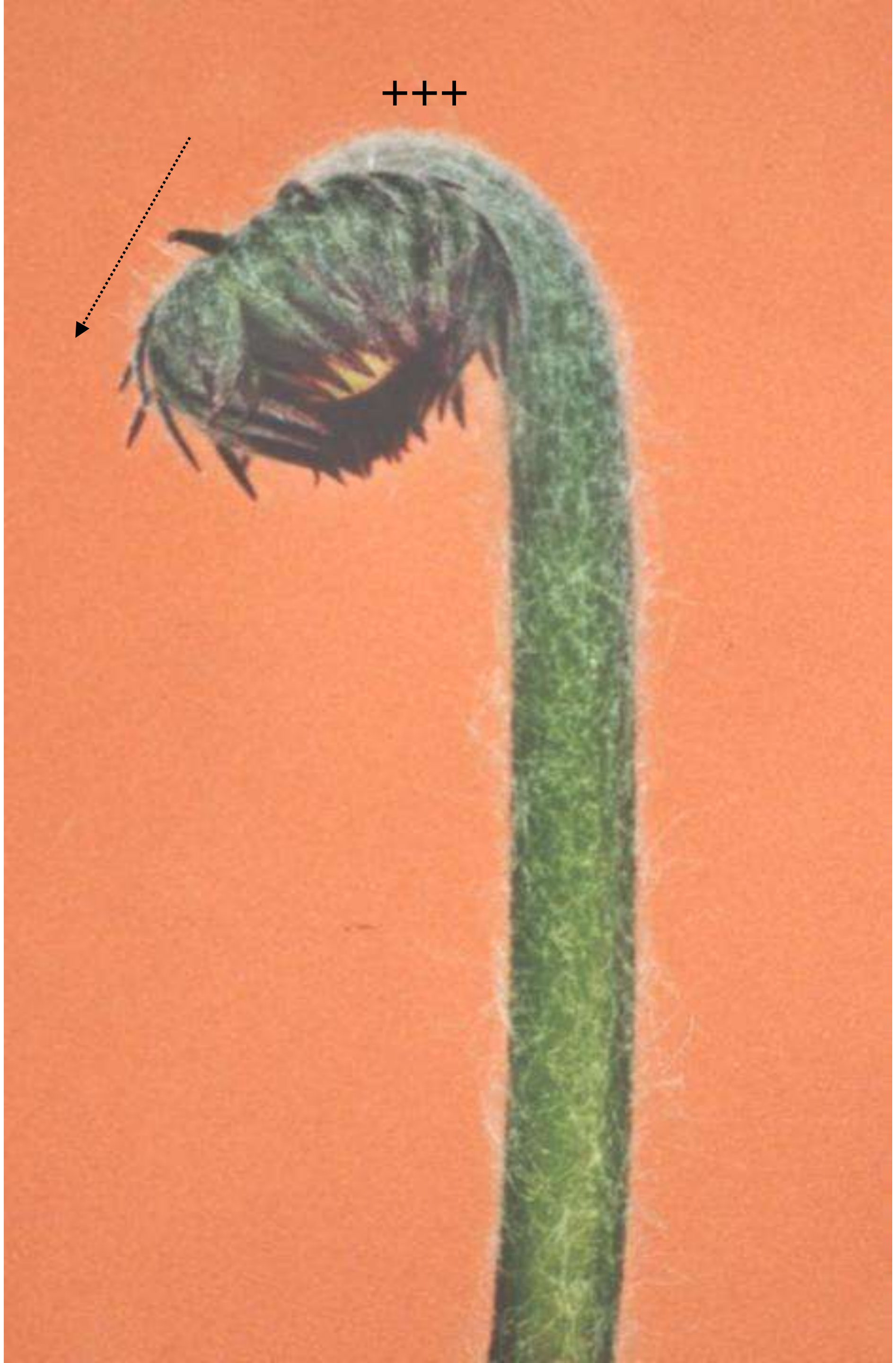
* Flower-head = the inflorescence

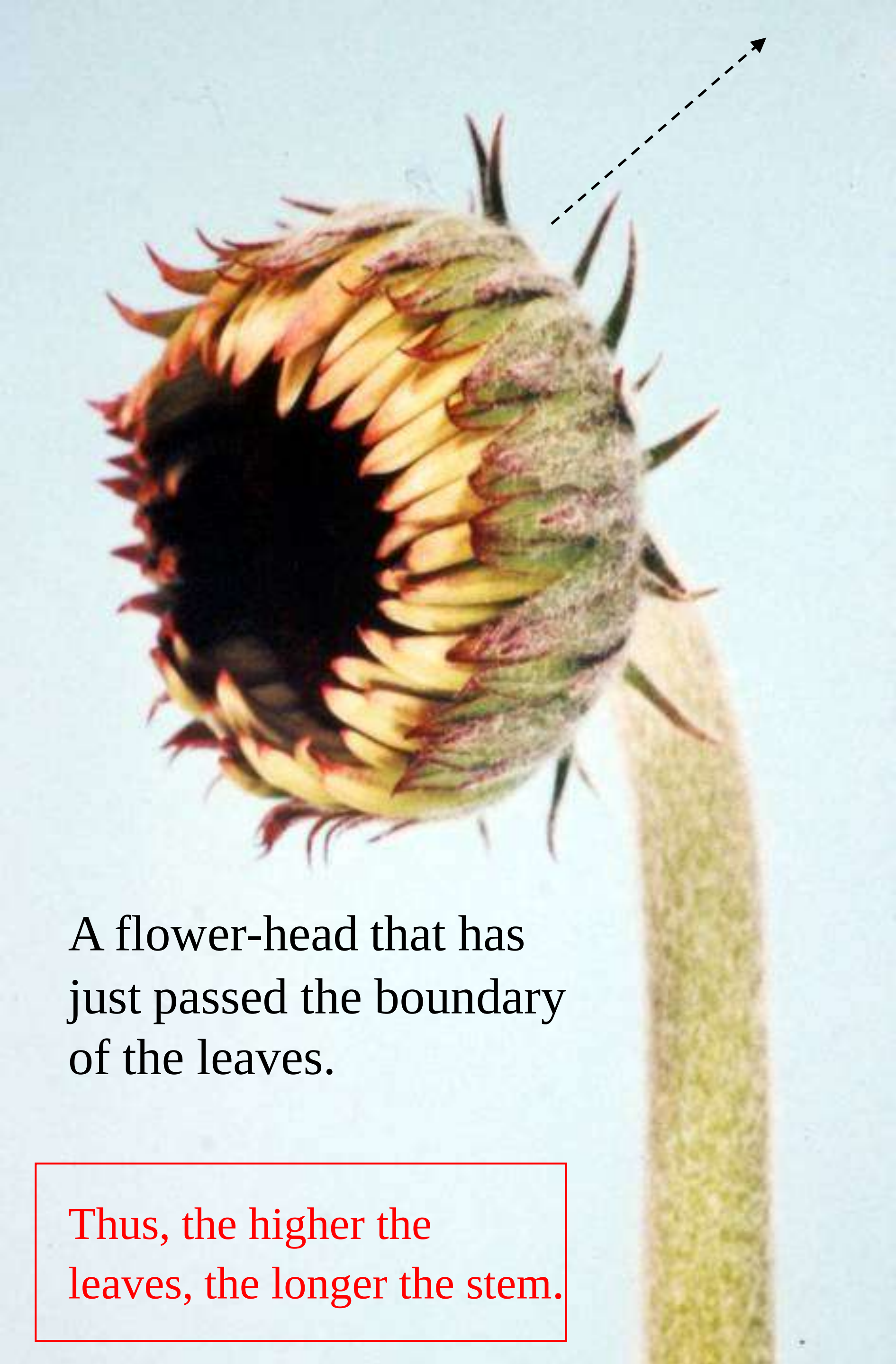


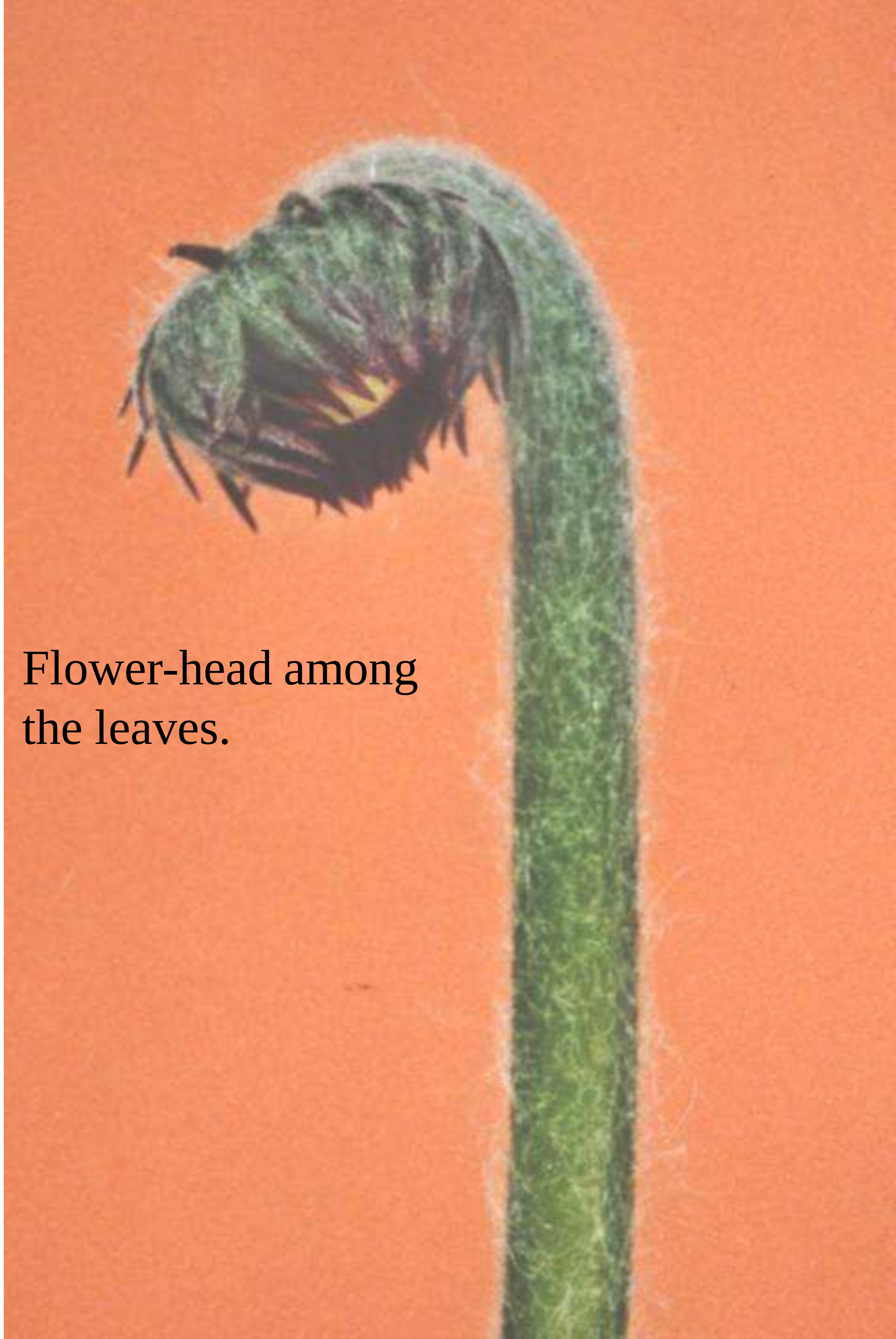
As long as the flower-head is located among and under the plant leaves, the stem continues to grow in a non-symmetric pattern.

This kind of growth protects the flower-head physically until it passes the leaves.

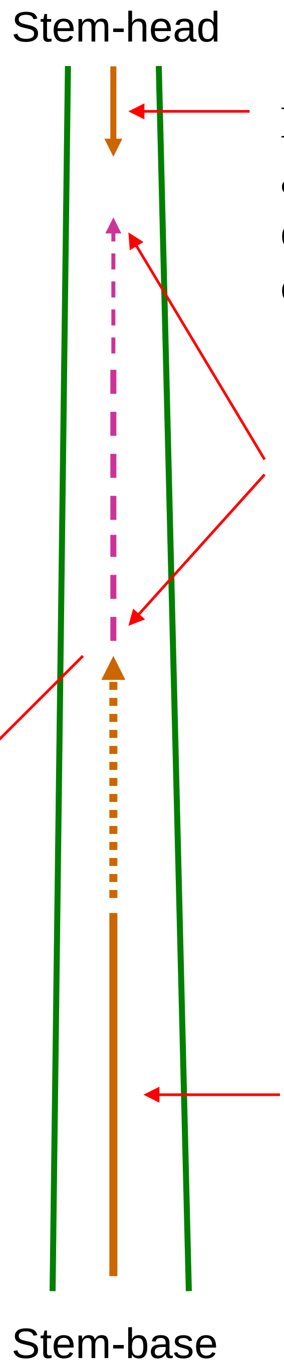
Later on, the direction of growth turns and the stem with the flower-head straightens upwards.




A flower-head that has just passed the boundary of the leaves.
Thus, the higher the leaves, the longer the stem.


Flower-head among the leaves.

Lignification stages of the gerbera stem.



A 2

Downward lignification at the stem-head starts early and stops after a few centimeters.

B

As long as elongation continues, the elongation sites remain flexible, and not yet lignified.

A 1

Upward lignification starts at the stem base and continues during stem elongation.

Never harvest gerbera flowers during the flexible stage ! !

The Flower

The gerbera originates in Barberton, Transvaal, South Africa.

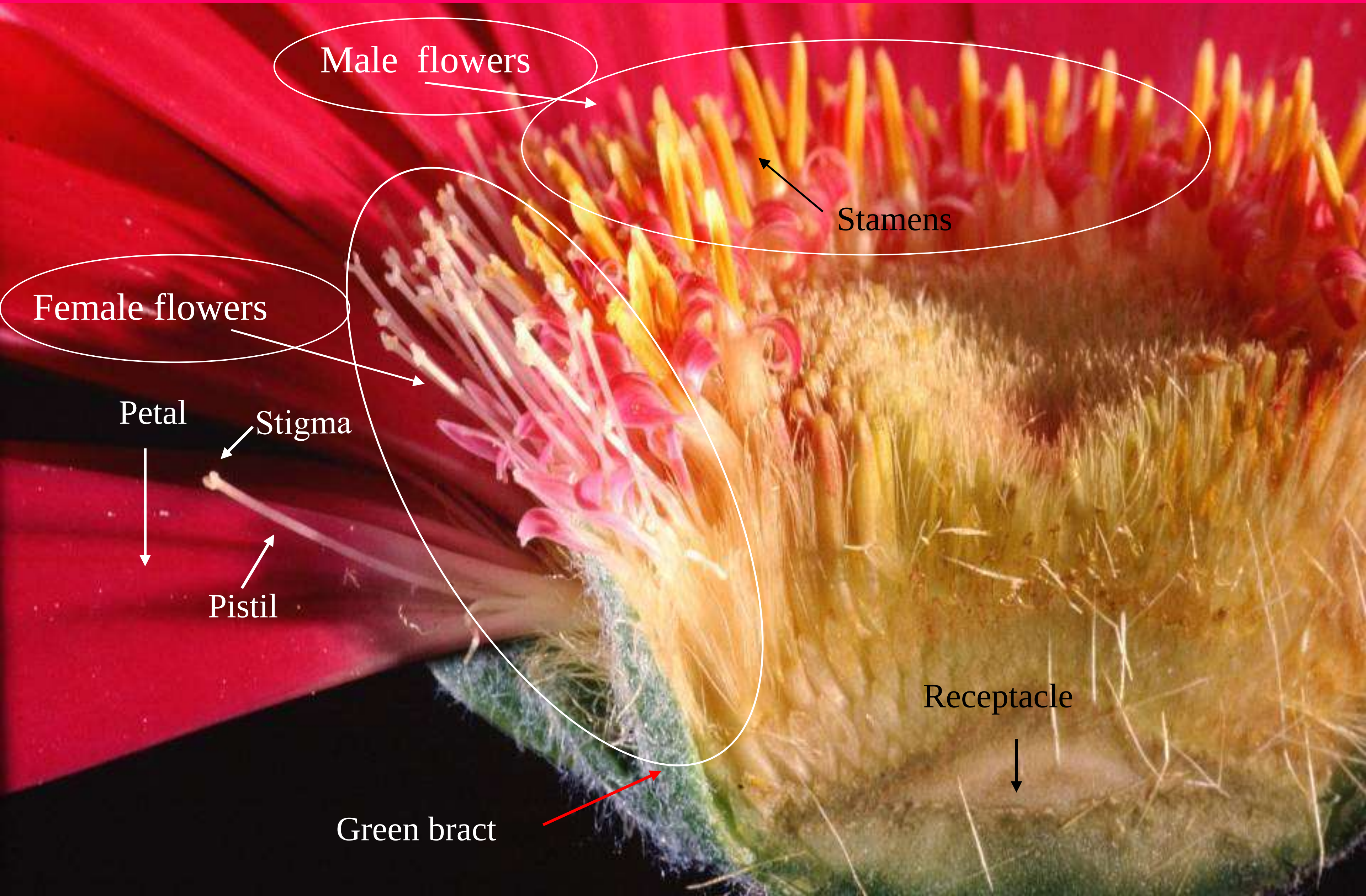
Gerbera jamesonii in nature -
Barberton, South Africa August 2006


Breeding code
3001-St7
The Gerbera
Inflorescence
Variety – Province

In the early stage the inflorescence-petals develop in a non-symmetric pattern.


The inflorescence-petals are symmetric in the mature stage.
Variety – Lorca

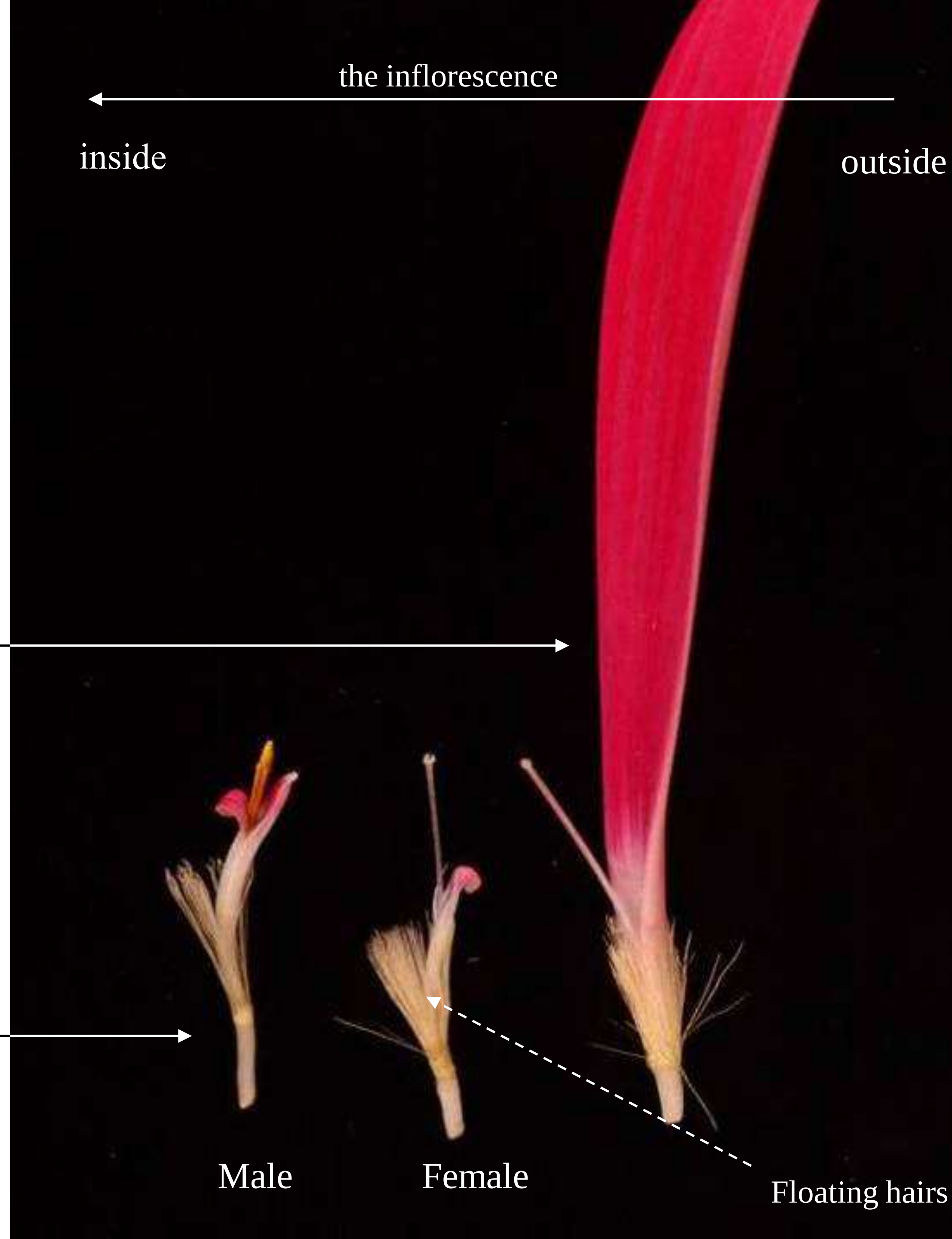
Cross-section of single-type gerbera-inflorescence.



Single-type flowers

Ligulate female flower

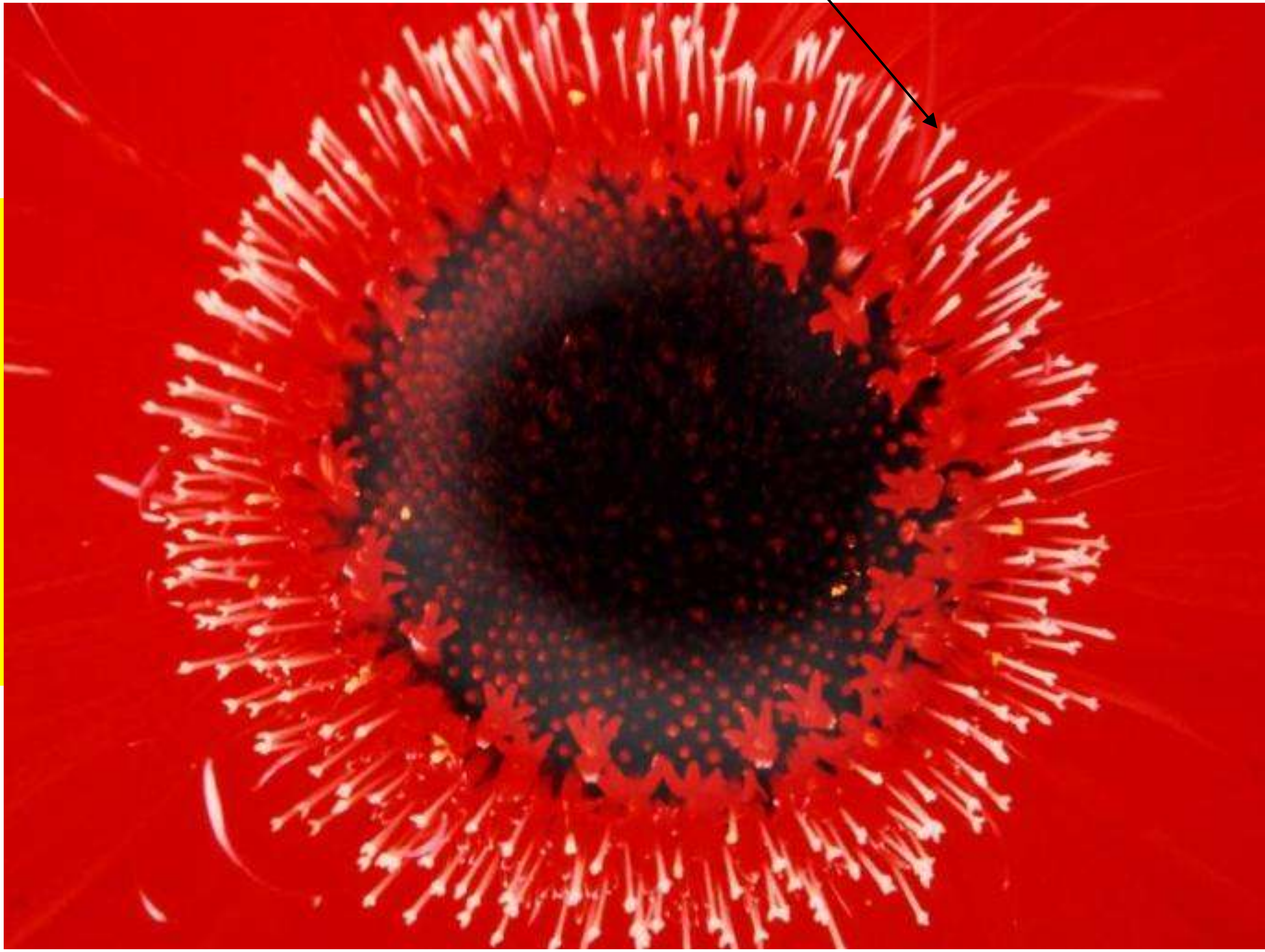
Tubular flowers



Double-type flowers

Ligulate flowers

The Female Stage - Only pistils are seen.



At this stage the stamens are not visible and the stem is not ready for harvest.

The flower stem is ready for harvest only when 2 circles of male flowers are seen.

The Male Stage - the same flower 2 days later with stamens.

When 2 circles of male flowers with stamens are seen, then the stem is ready for harvest.

SALINITY

Salinity is the enemy of intensive agricultural crops.

Growers of intensive crops used to fertilize with lots of minerals.

Obviously, however, intensive plants normally retain only 5%

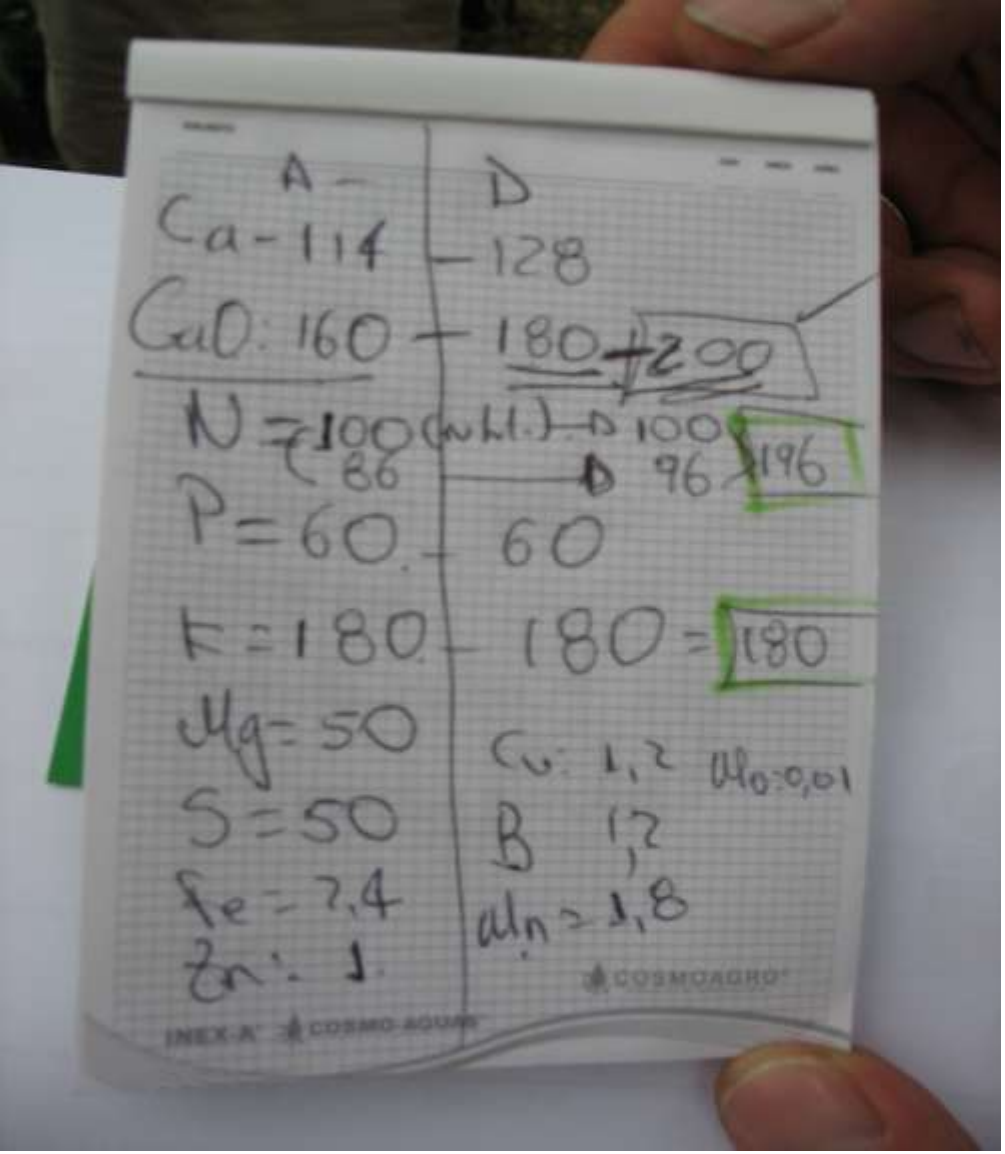
of the total supplied minerals (the dry matter).

The presence of the unused minerals in the root volume

creates the Salinity Problem.

It is we who cause the salinity and we cannot ignore it.

It demands our attention and action.



Feeding formula commonly used in Colombia

2 Feeding Formulas used for gerbera

(among other practice possibilities)

Element (ppm)	N	P	K	Ca	Mg
Standard	200	70	270	120	50
Saving	70	20	90	45	15
Difference %	35	29	27	38	30

Under conditions of salinity the secondary roots are damaged and there are not enough root hairs to absorb the soil solution needed for normal growth and production.

Stages of salinity damage in gerbera

Sensitivity to disease increases

Vegetative growth increases

Flower production goes down

Minerals accumulate in the leaves, leaves become rigid

Flower diameter is reduced, colors fade

Stems become shorter

Difficulties of soil solution uptake

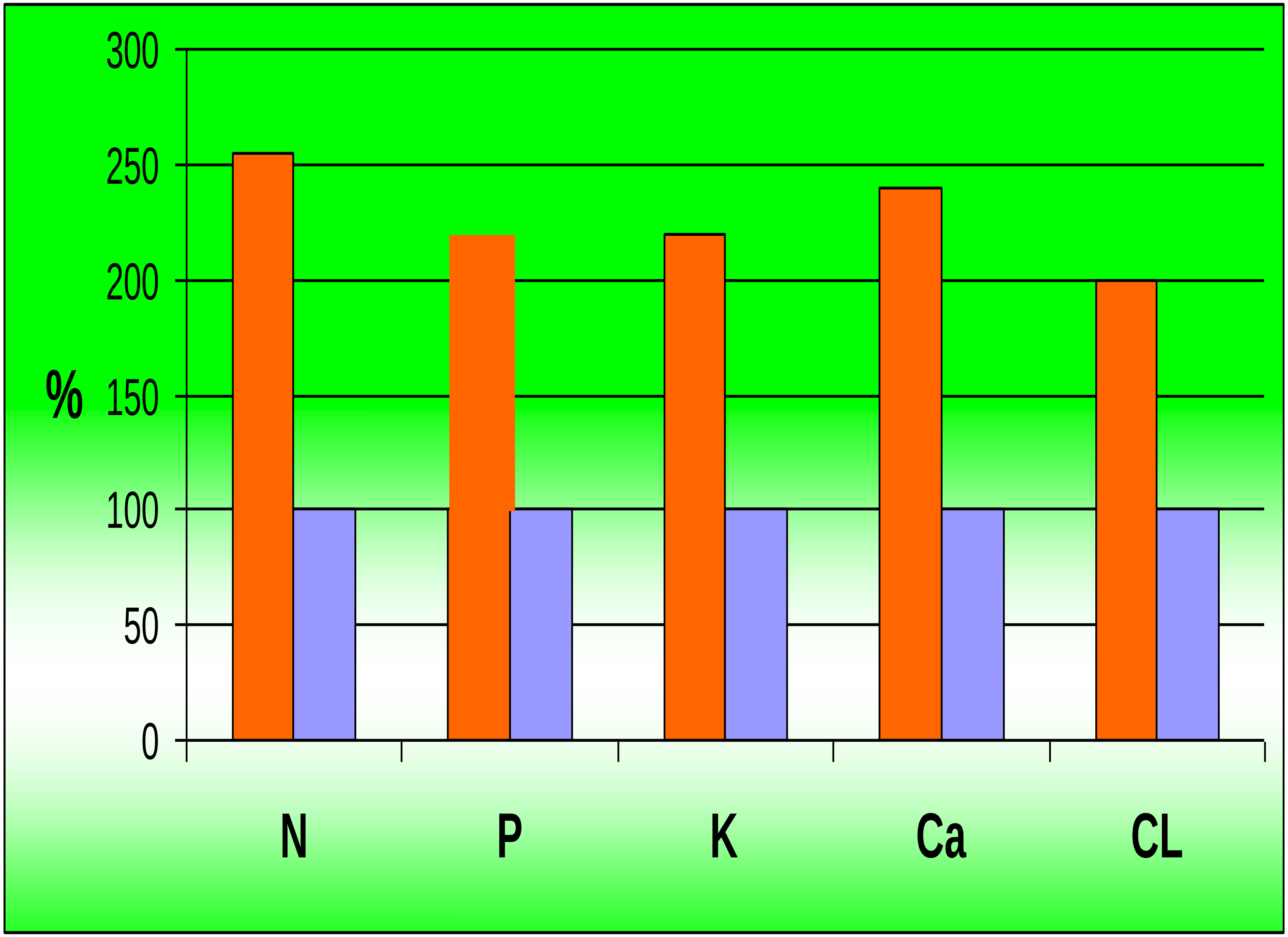
Root burning

Deadly damage to gerbera inflorescences caused by salinity


Burned gerbera roots
The secondary roots can be renewed, but recovery processes in the soil are relatively slow.
Total loss of a gerbera greenhouse as result of salinity.

Root performance in various media, Colombia.


Normal production
Salts have accumulated in the leaves and production is gone.



Leaf analysis

% / dm

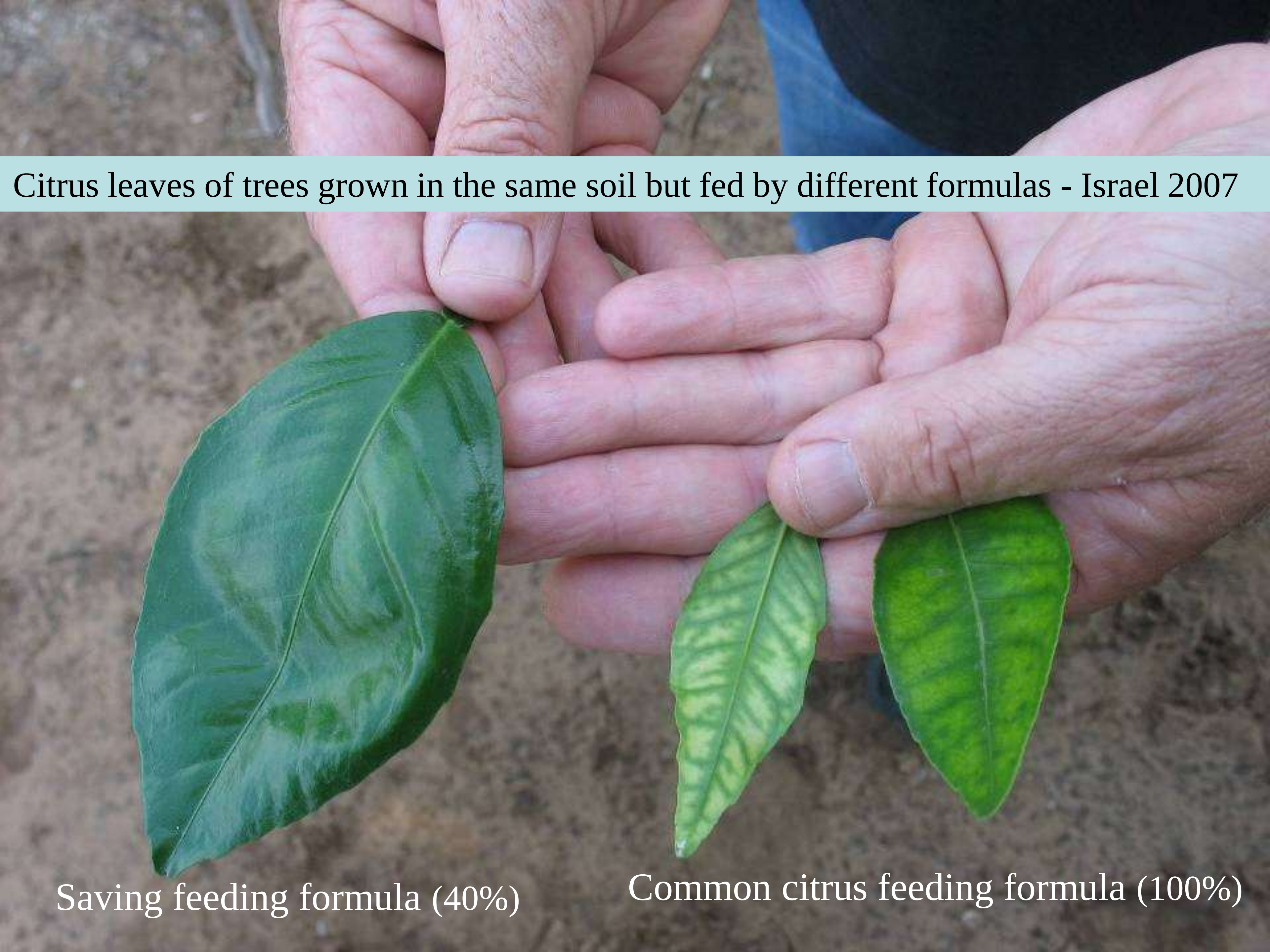
	N	P	K
‘Normal’	1.5	0.22	3.3
Salty	3.9	0.50	4.5

Mineral accumulation in gerbera leaves under salinity conditions.

Normal leaves

Salty leaves

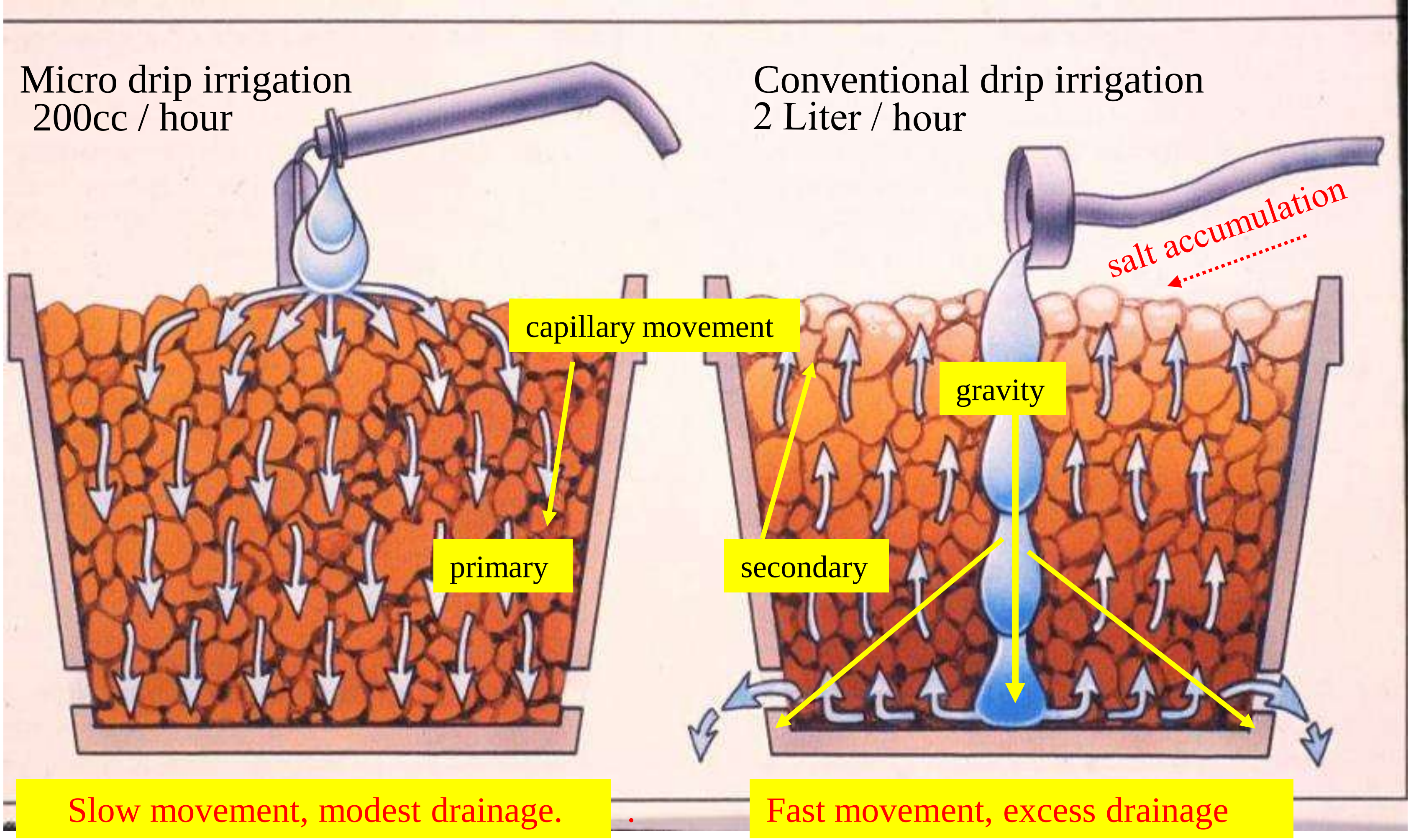

Mineral deficiency as seen in the leaves could be a result of salinity conditions, and not a result of deficiencies in the soil solution.


Citrus leaves of trees grown in the same soil but fed by different formulas - Israel 2007
Saving feeding formula (40%)
Common citrus feeding formula (100%)

FERTIGATION & SALINITY

Water movement and salt accumulation.

Oxygen availability and daily plant activity.

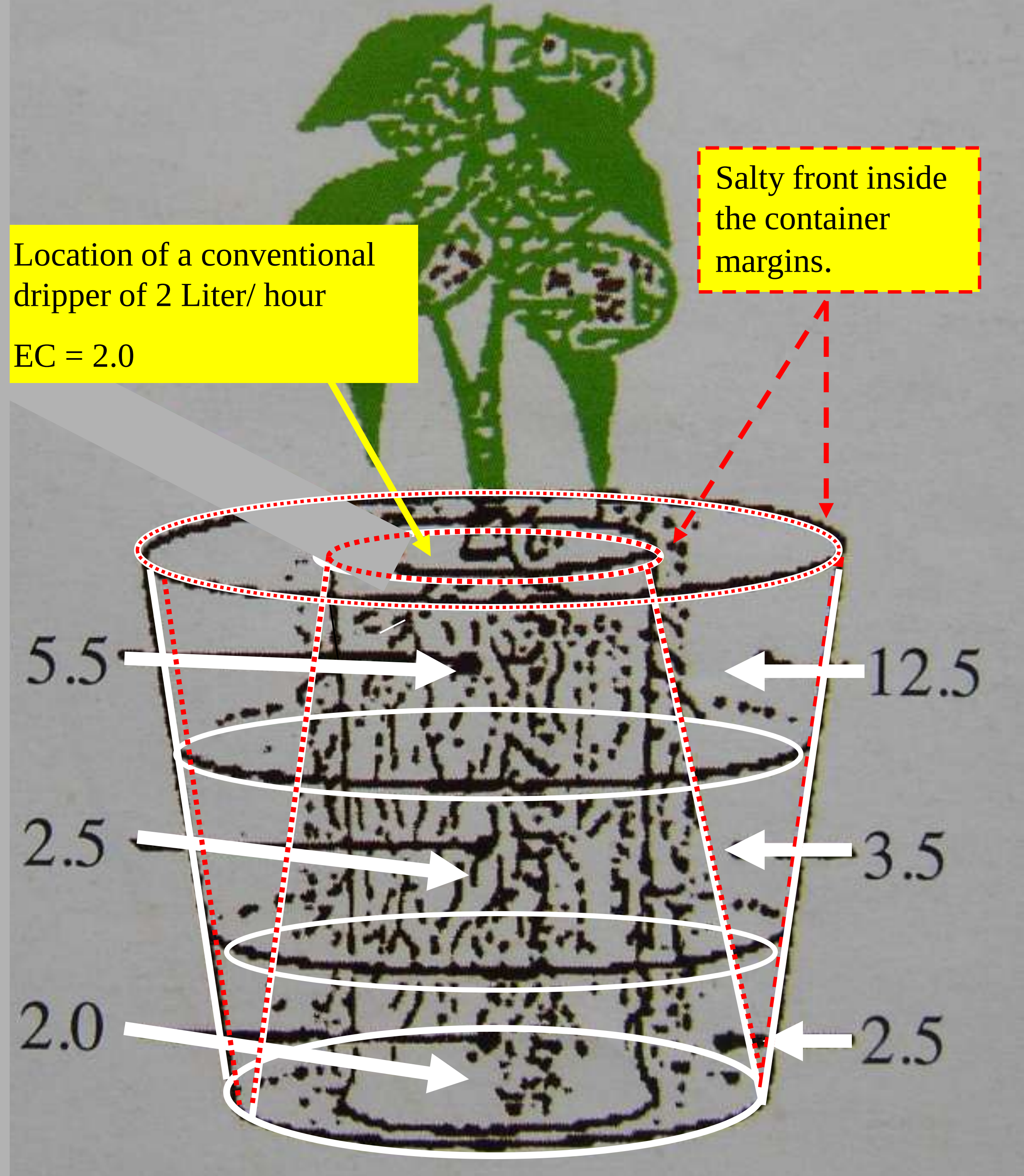


Capillary water movement versus gravity movement

Micro drip irrigation enables capillary water movement throughout the entire root volume and avoids salinity with modest drainage.

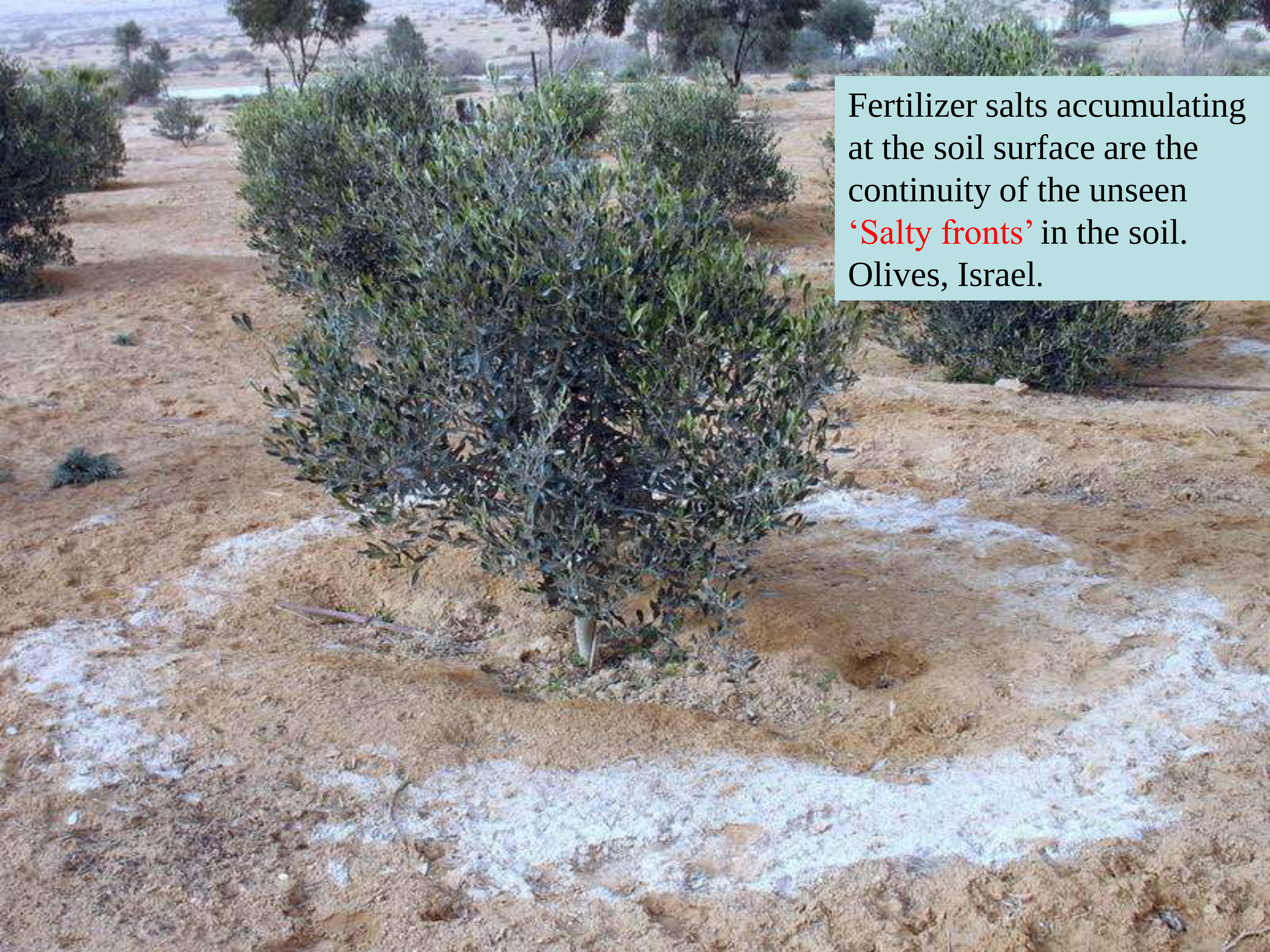
Conventional drip irrigation creates fast gravity movement and excess drainage, but at the same time enables upward capillary movement of water and salts.

Salinity development as result of conventional irrigation in containers

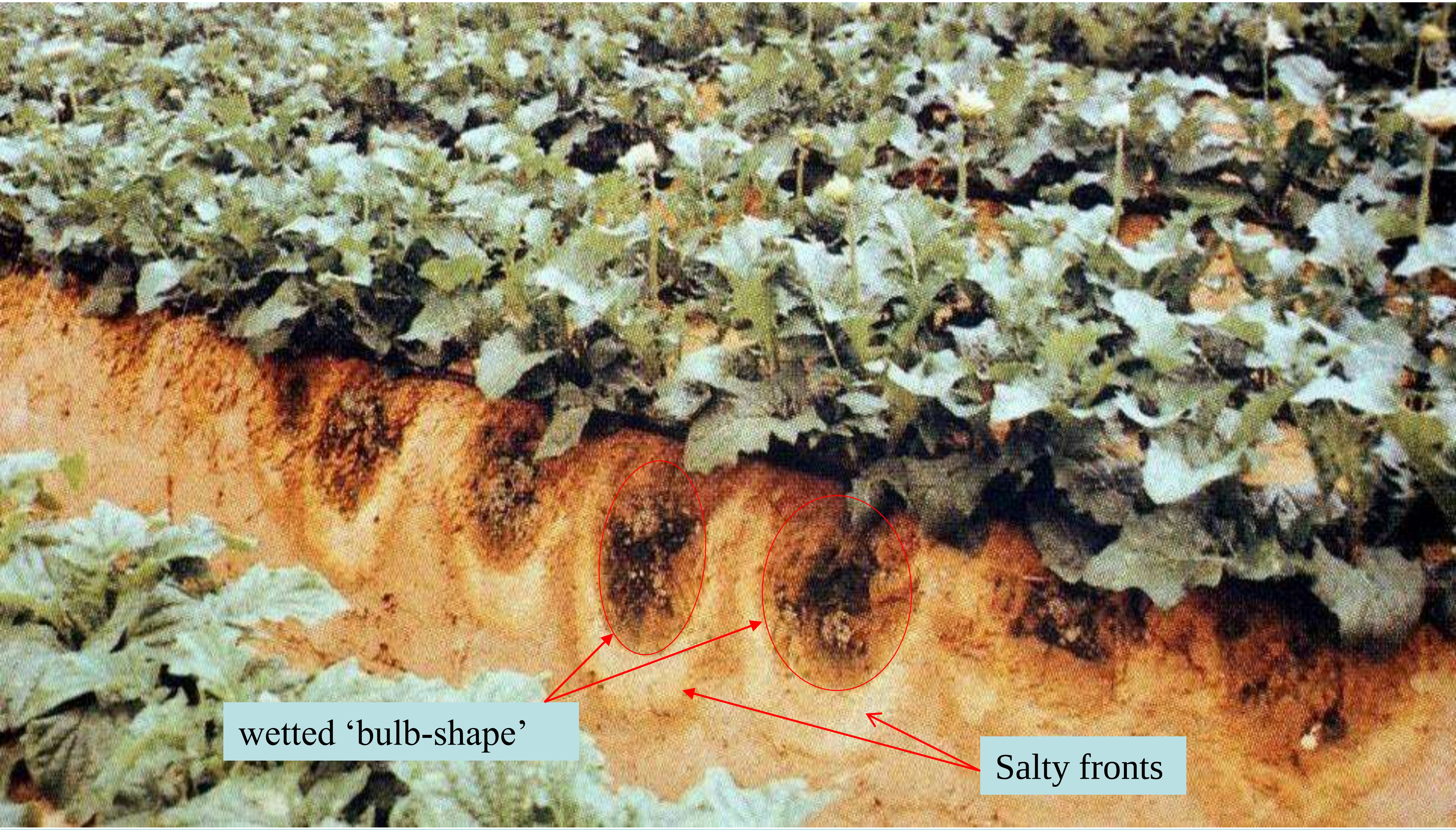


Schematic figure of real EC values, in 6 different sections of a gerbera container, several weeks after planting.

Evaporation of water and upward mineral diffusion transfers minerals to the soil surface over the 'salty fronts'. Gypsophila, Ecuador.



Fertilizer salts accumulating at the soil surface are the continuity of the unseen 'Salty fronts' in the soil. Olives, Israel.



Gravity water movement below the drippers creates the so-called: ‘wetted bulb-shape’.

Continuous fertigation creates ‘Salty fronts’ around the ‘wetted bulbs’.

Normally, the ‘Salty fronts’ are not seen by the growers.

Salinity results in short:

Damage to the plants and their products

Wasting of fertilizers and water

Pollution of our drinking water

It is we who cause the salinity

and we cannot ignore it.

It is in our hands to create the optimal growing conditions for efficient roots activity.

Oxygen availability in the soil solution & plant activity

Oxygen is of utmost importance for the plant as it is involved in

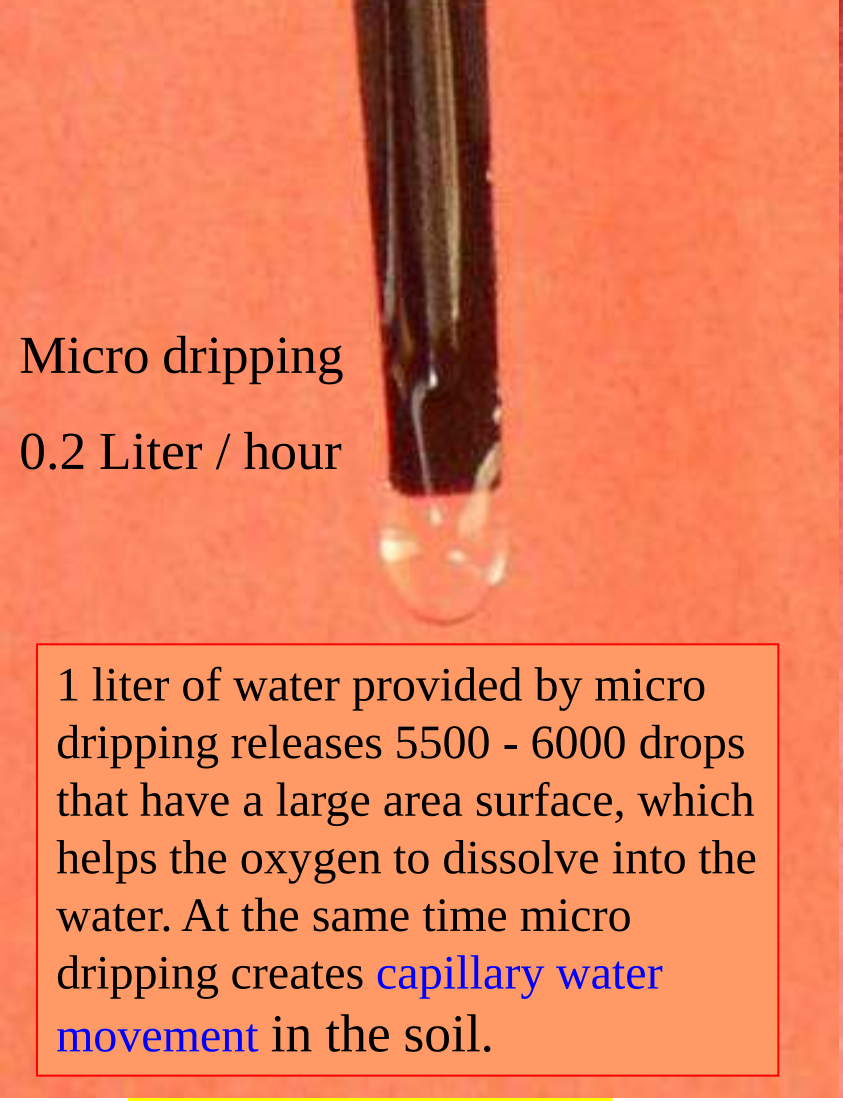
almost all its physiological activities.

The oxygen present in the soil pores is dissolved in the soil solution

and enters the plant while water is being absorbed by the plant roots.

This is the only way the atmospheric oxygen can infiltrate into the plant tissue.

Thus we may say: The plant's interest lies in the soil-solution and not in the soil structure.

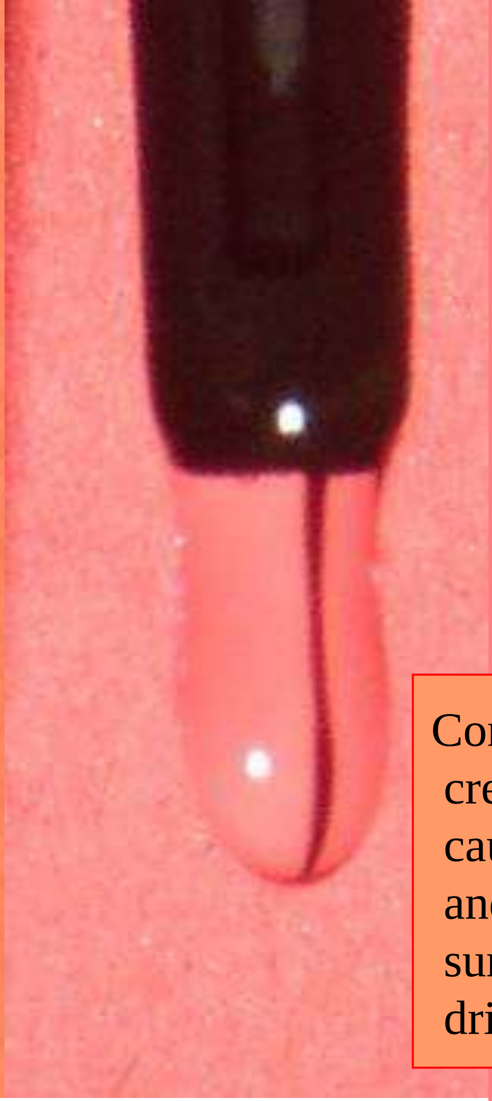


Micro dripping

0.2 Liter / hour

1 liter of water provided by micro dripping releases 5500 - 6000 drops that have a large area surface, which helps the oxygen to dissolve into the water. At the same time micro dripping creates capillary water movement in the soil.

High oxygen availability



Conventional dripping

2 Liter / hour

Conventional dripping creates micro water flow that causes gravity movement and has a smaller water area surface compared to micro-dripping systems.

Low oxygen availability

Capillary water movement versus gravity water movement

as regards oxygen availability

Daily plant activities -

Plants daily utilize water, light, CO_2, oxygen and minerals for the following processes:

Transpiration of water vapors for cooling plant tissues and avoiding radiation damage, by transportation of water oxygen and minerals from the soil solution, throughout the day hours.

Assimilation (photosynthesis) of CO_2 and water, supported by light energy, for producing carbohydrates (sugars), throughout the day hours.

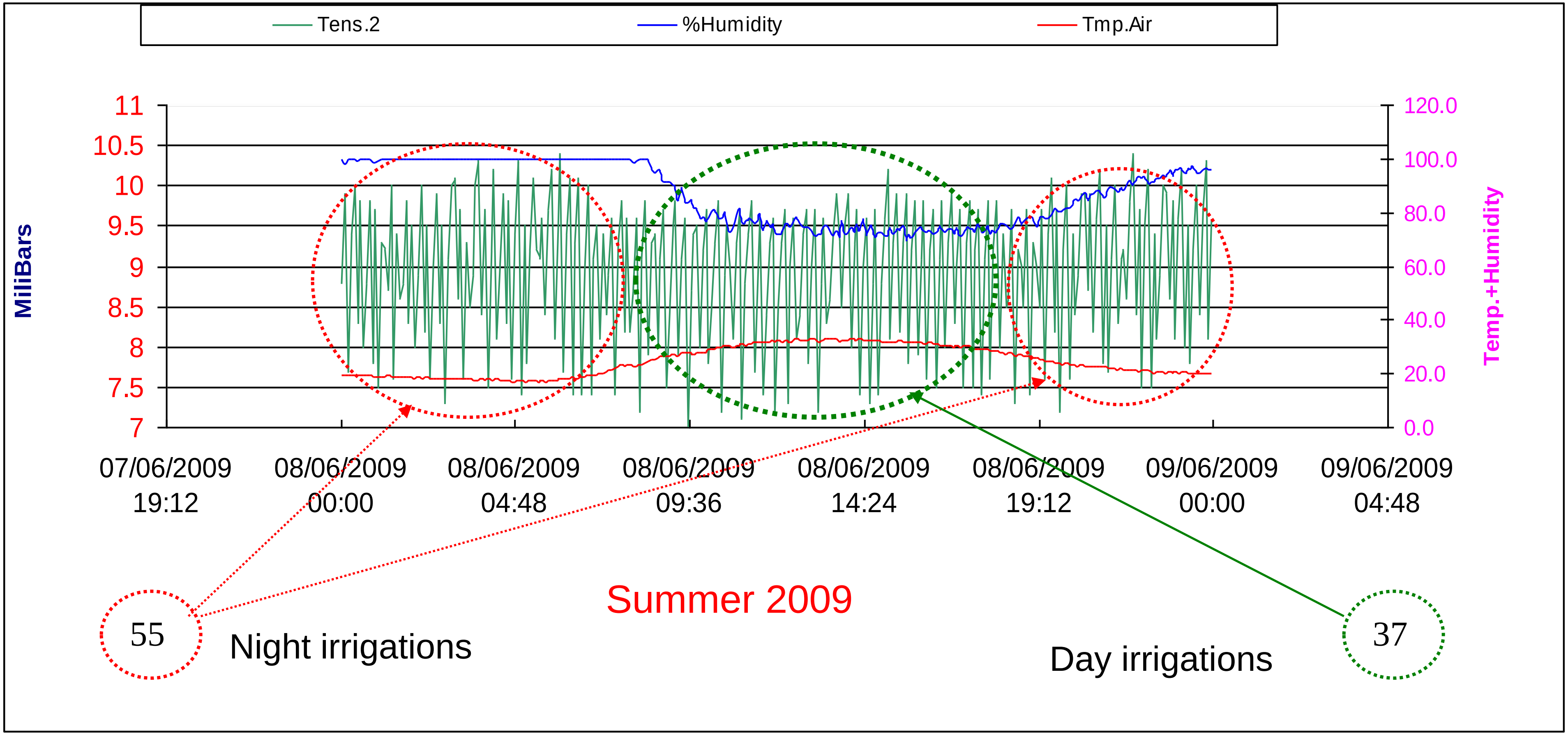
Translocation of water oxygen and minerals from the soil solution, and of carbohydrate products from the leaves by the plant sap, to the growing sites, throughout the dark hours.

Respiration (oxidation processes utilizing oxygen) for supplying the energy used for the biological activities, throughout 24 hours.

Growth and development by means of cell division and cell elongation throughout 24 hours.

And as the plants consume water and oxygen continuously during 24 hours, it means that

for the benefit of modern agriculture we have to monitor and control our crops constantly.



24-hour data (water tension, irrigation pulses, temperature and humidity) characterize the growing conditions and the physiological activities of gerbera plants grown in 4-liter containers in a greenhouse, as controlled by the 'Auto Agronom' irrigation control system. Israel, June 2009

4 fundamental questions facing growers of intensive crops:

When to irrigate - and how much to irrigate

When to fertilize - and how much to fertilize

These fundamental questions are waiting for our sophisticated solutions.*

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* Go to the AutoAgronom chapter in this website

The end