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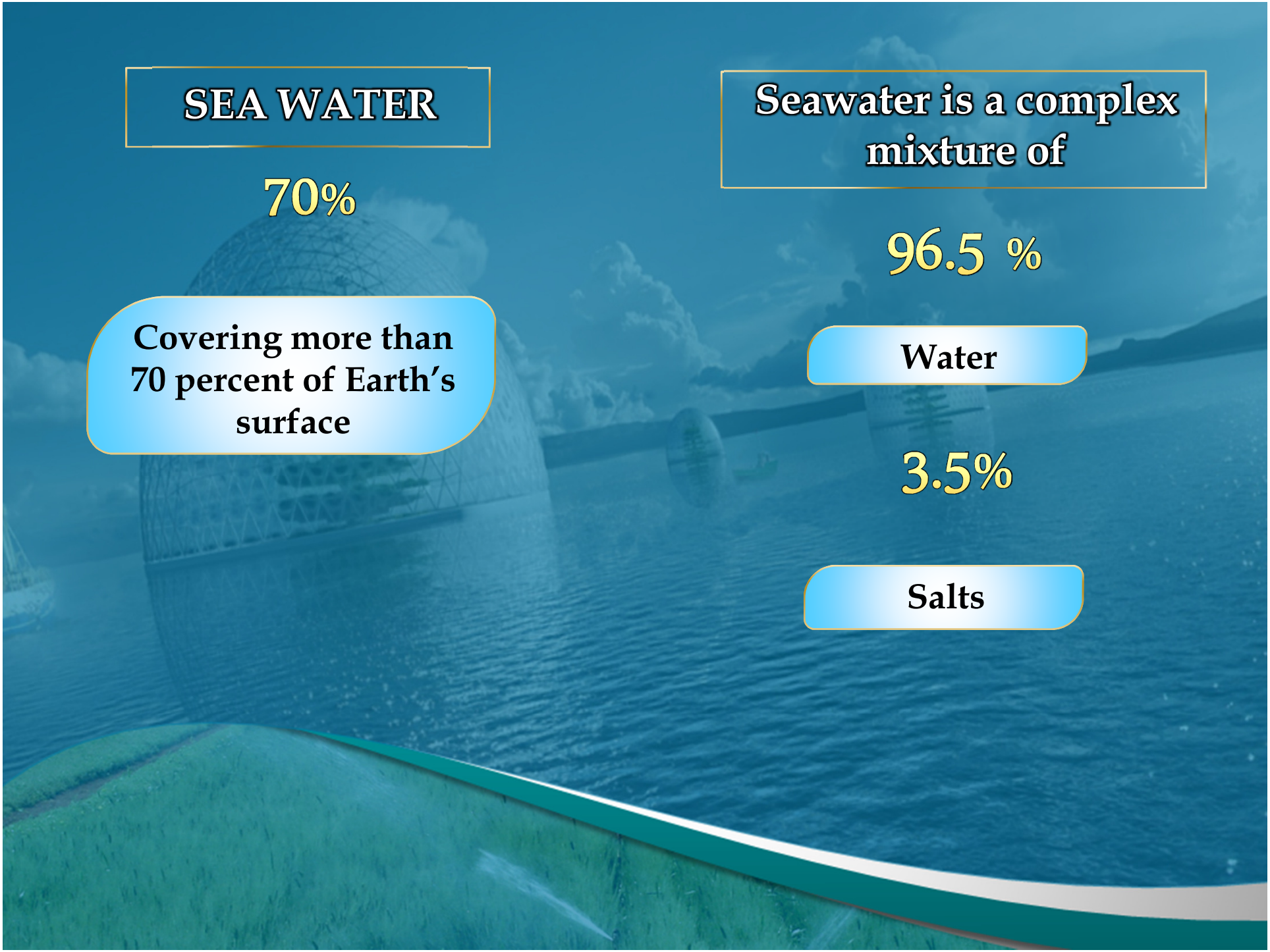
# USAGE OF SEA WATER IN AGRICULTURE

## "An Overview"


*By*

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SEA WATER
70%
Covering more than 70 percent of Earth's surface
Seawater is a complex mixture of
96.5 %
Water
3.5%
Salts

# Salinity and the main salt ions

## The salinity of sea water

(Usually 3.5%)

The salinity of sea water is made up by many dissolved salts like, NaCl.

# Salinity and the main salt ions

The main nutrients for plant growth

Nitrogen

- N as in nitrate $NO_3^-$
- Nitrite $NO_2^-$
- Ammonia $NH_4^+$

Phosporus (P as phosphate $PO_4^{3-}$)

Potassium (K)

Sulfur (S)

Magnesium (Mg)

Calcium (Ca)

# Seawater agriculture

Sea water may
be used in plant irrigation
especially in arid and
semi-arid areas, which
falls under biosaline
agriculture



# Seawater agriculture should fulfill two requirements to be cost-effective

**First**

It should produce useful crops at yields high enough to justify the expense of pumping irrigation water from the sea

**Second**

Researchers should develop agronomic techniques for growing seawater- irrigated crops in a sustainable manner- one that does not damage the environmental saline agriculture


The development of seawater agriculture may take a direction of attempting to breed salt tolerance into conventional crops, such as barley and wheat, by genetic engineering for example

# Saline agriculture holds promise for biofuels

Around 10,000 salt-loving halophyte plants, which can grow in deserts and thrive on seawater – now at last coming to light

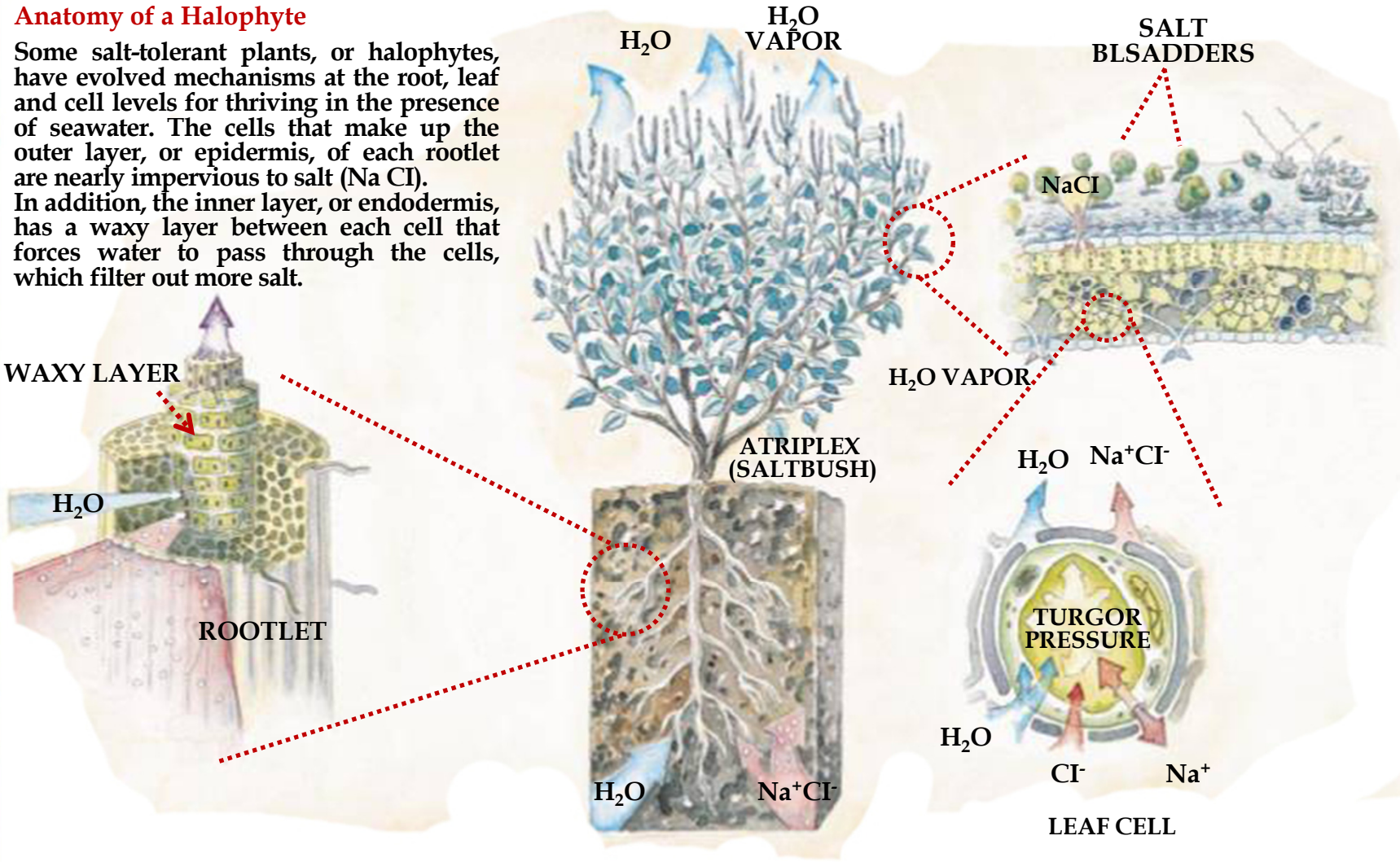
Noting that halophyte plants can provide humans with food, fiber, edible oils and biofuels

Indeed, algae grown on seawater are biofuels based on

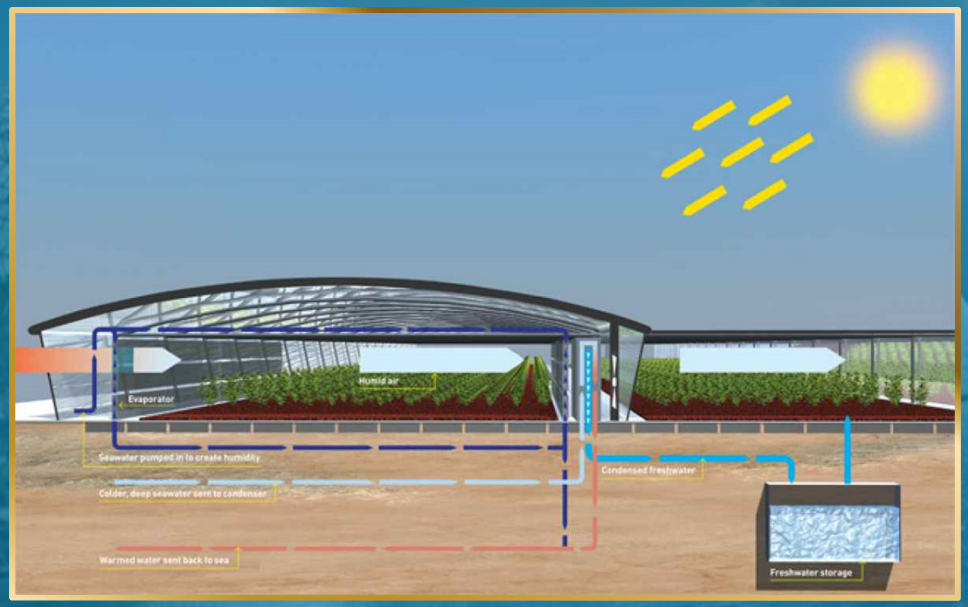
# Irrigation crops with sea water

## Anatomy of a Halophyte

Some salt-tolerant plants, or halophytes, have evolved mechanisms at the root, leaf and cell levels for thriving in the presence of seawater. The cells that make up the outer layer, or epidermis, of each rootlet are nearly impervious to salt (Na CI).
In addition, the inner layer, or endodermis, has a waxy layer between each cell that forces water to pass through the cells, which filter out more salt.



# Seawater Greenhouse



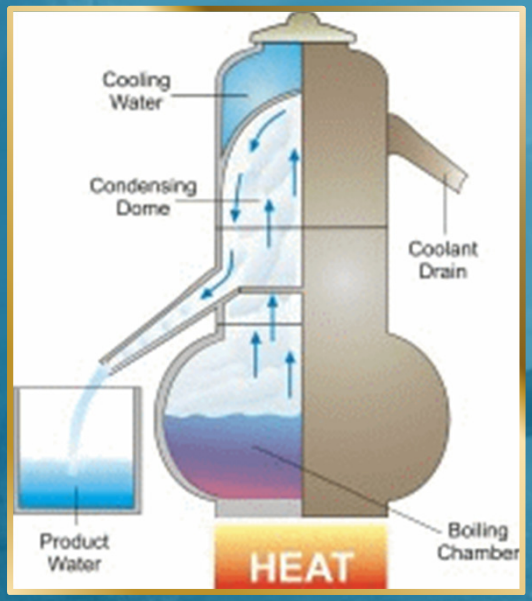

**A seawater greenhouse is a greenhouse structure that enables the growth of crops in arid regions, using seawater and solar energy**

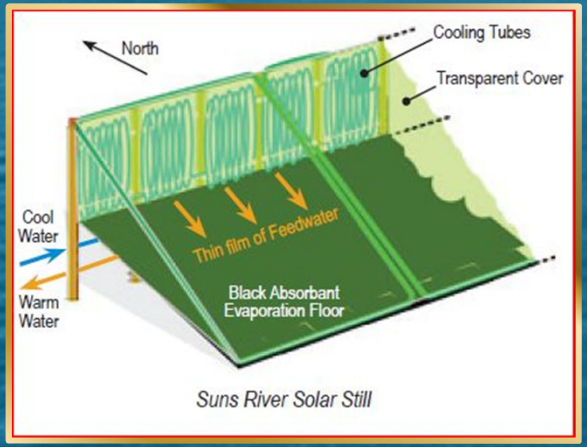
The technique involves pumping seawater (or allowing it to gravitate if below sea level) to an arid location and then subjecting it to two processes:

**First** — It is used to humidify and cool the air

**Second** — It is evaporated by solar heating and distilled to produce fresh water

Finally, the remaining humidified air is expelled from the greenhouse and used to improve growing conditions for outdoor plants

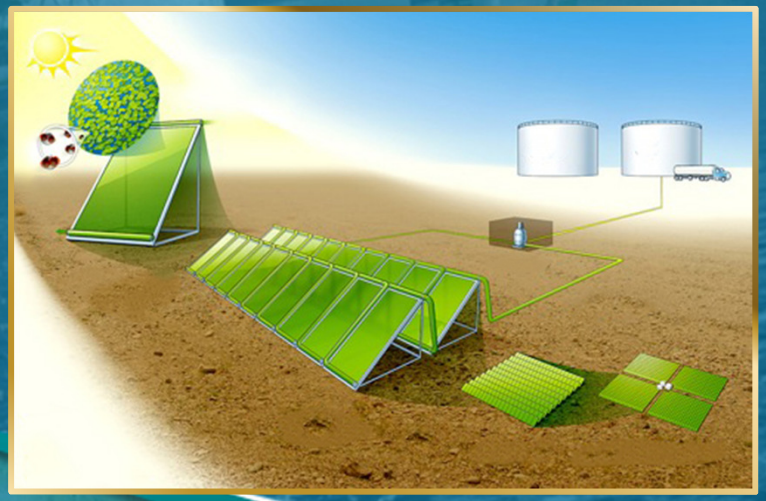


Suns River Solar Still

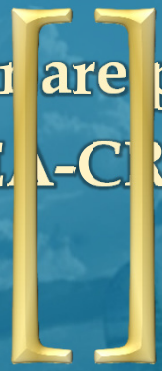
The more concentrated salt water may either be further evaporated for the production of salt and other elements, or discharged back to the sea

The seawater greenhouse is a response to the global water crisis



# Seawater active organic substances

Many gallons of seawater are processed to produce a single gallon of SEA-CROP concentrate.



# Seawater active organic substances



# Salt Tolerance of Selected Plant Species

## *Three Classes*

**Moderately salt tolerant** plants always need protection from salt spray but will tolerate some inundations by storm surges. They are best used behind fences or buildings

**Slightly salt tolerant** plants always need protection from salt spray and should be protected by fences and buildings

# The following table is grouped by type of plant: trees, palms, shrubs, vines, ground covers

| | Salt tolerant | Moderately salt-tolerant | Slightly salt-tolerant |
|---|---|---|---|
| Tree | Southern Magnolia (Magnolia grandiflora) | (Callitris pressii) Russian Olive | Poplar (Populus alba) |
| Palms | Cabbage Palm (Sabal palmetto) | Pygmy Date Palm (Phoenix roebellini) | |
| Shrubs | Dwarf Yaupon (Ilex vomitoria varieties) | Hydrangea (Hydrangea macrophylla) | Poinsettia (Euphorbia pulcherrima) (D) |
| Cactus, Yuccas and Succulents | Nelson's Blue Beargrass (Nolina nelsonii) | Hedge cactus (Cereus peruvianus) | |

# The following table is grouped by type of plant: trees, palms, shrubs, vines, ground covers

| | Salt tolerant | Moderately salt-tolerant | Slightly salt-tolerant |
|---|---|---|---|
| Grasses | Bermuda Grass (Cynodon dactylon) | Bahia Grass (Paspalum notatum | Centipede Grass (Eremochloa ophiuroides) |
| Ground cover, Ferns and Vines | Algerian Ivy (Hedera canariensis) | Asparagus Fern (Asparagus densiflorus) | Coleus (Coleus blumei) |

# Seawater for Green Deserts?!

Deserts on earth, in fact, cover a huge surface area

But

In case of work to make the deserts green
by seawater irrigation

# Seawater for Green Deserts

**Advantage**

large amounts of water with organic fertilizers.

**Disadvantages**

Sodium would damage the clay minerals, that good desert soil would be totally and irreversibly spoiled.

It is not economic to pump seawater over long distances (with corrosion problems on pumps and pipes), to accumulate salt in concrete basins in inland deserts and to spoil soils in oasis or lower aquifers of good water.

# Seawater for Green Deserts

## How greenification should occur ?!

**Planting long living trees is the only choice for binding $CO_2$ for a longer period**

# Management of salinity problems



# Hydroponics and seawater

Researches proved that great variety of vegetables and flowers grown flourished in the Seaponic solution

For ex., Orchids grew beautifully with the Seaponic solution as an only source of fertility




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Thank
You