Aquaponics

Module 4

Growing more fish and plants for human consumption and enjoyment

Module 3 - Filters, Feed and Fish

What are the filter types?

- Bacci tower
- Vortex
- Ebb and Flow
- Flow through
- NFT Nutrient Film Technique
- DWC Deep water culture

What ways can we aerate?

- Venturi
- Sheeting
- Air stones
- Dropping, manual stirring, wind

Name Plants for feed?

Name Plants for Profit?

What are some of the best fish for culture?

- Tilapia, Gurami, Carp, Catfish, mudfish
- Trout, Perch, Blue gill

Bed types for plant types

1. **Soil based Plants get soil**
2. **Water based plants get gravel**
3. **Floating Plants get to Float**

Develop safe reliable system using one pump
- ✓ Utilize gravity
- ✓ Understand head, hp to watts to kwh to cost
- ✓ GFIC required

Understanding dissolved oxygen
- ✓ Venturi
- ✓ Sheeting
- ✓ Use Flow form aeration where ever possible

Understanding filtration
- ✓ Gravel beds for trapping solids and also for additional biofiltration
- ✓ Ebb and flow – Build simple bell siphon prototype
- ✓ Flow through beds
- ✓ NFT- Nutrient film technique
- ✓ Low cost main biofilter

Plants are for
- ✓ Nitrate removal
- ✓ Ammonia removal
- ✓ CO_2 / carbonic acid production

Meet plant fertilizer needs
- ✓ Grow plants in soil if not aquatic
- ✓ Soil based plants - vermicast, cocopeat
- ✓ Dependant on capillary action of potting soil – we have ideal materials


Vegetables
Potting soil wicks moisture
NFT

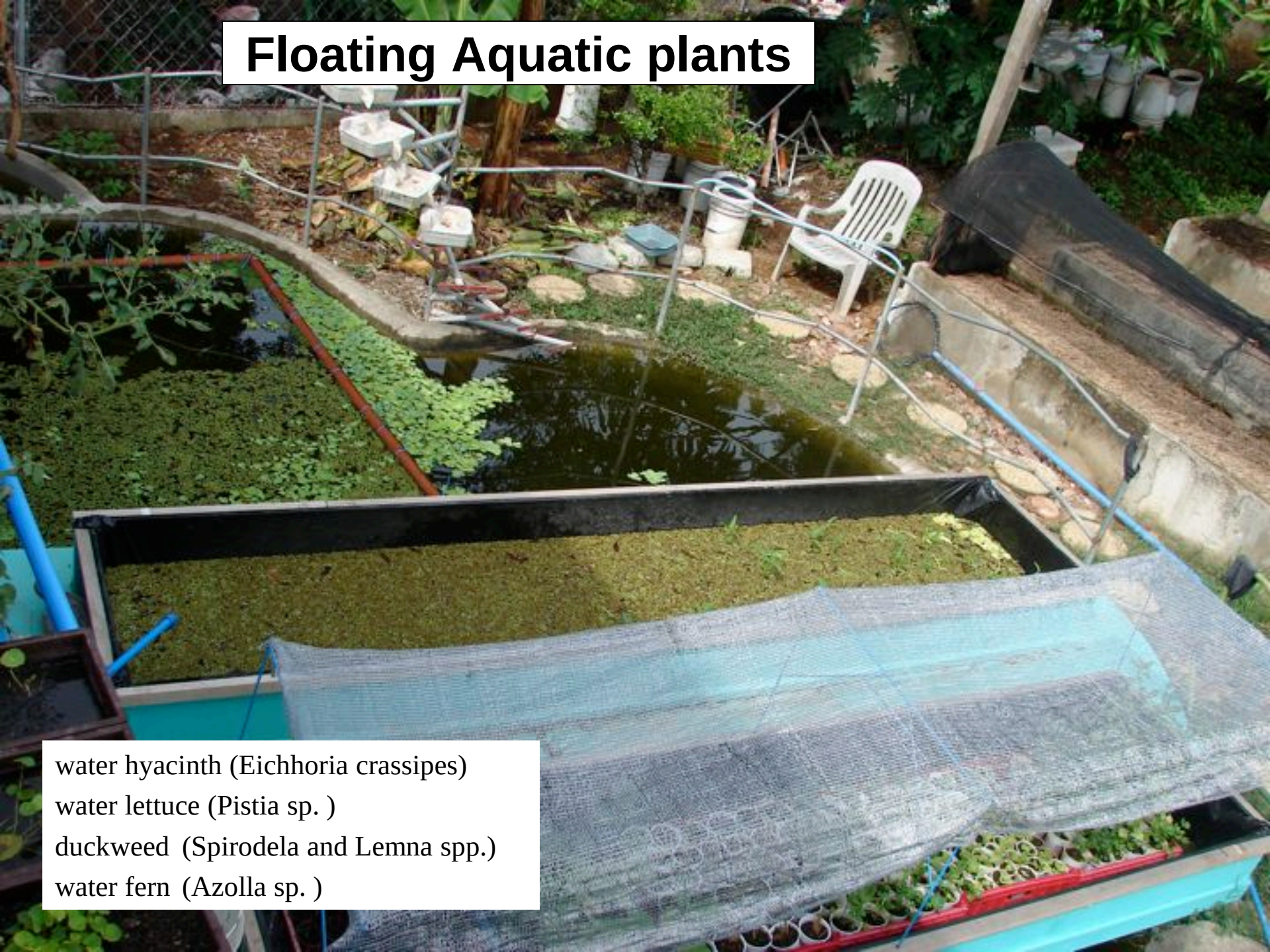
Vegetables

Potting soil provides the soil food web

NFT


Batchoy, celery, lettuce

Floating Aquatic plants



water hyacinth (Eichhoria crassipes)
water lettuce (Pistia sp.)
duckweed (Spirodela and Lemna spp.)
water fern (Azolla sp.)

Emergent plants

Semi submerged aquatic plants

Bed types for plant types

1. **Soil based Plants get soil**
2. **Water based plants get gravel**
3. **Floating Plants get to Float**

watercress (Nasturtium officinale)

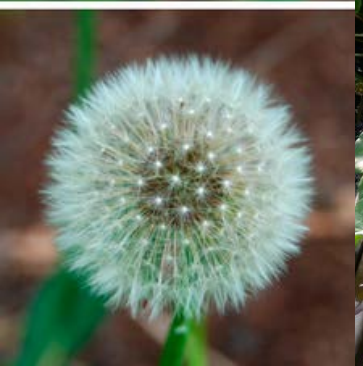
water chestnut (Eleocharis dulcis)

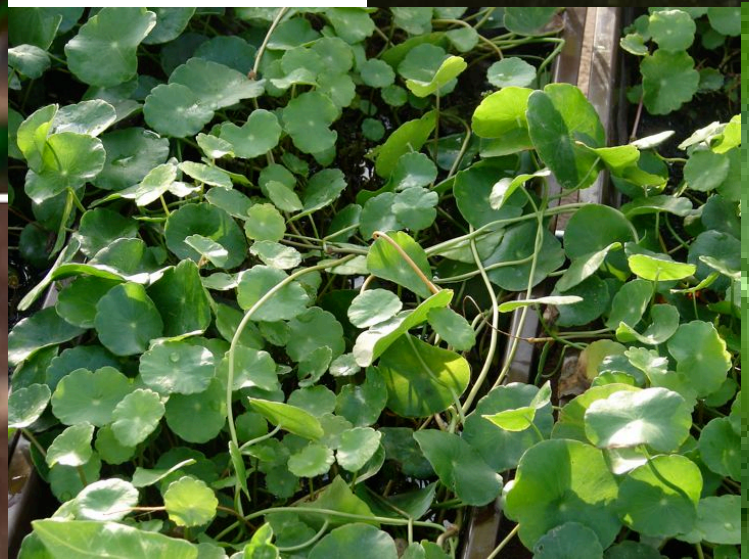
water spinach (Ipomoea aquatica)

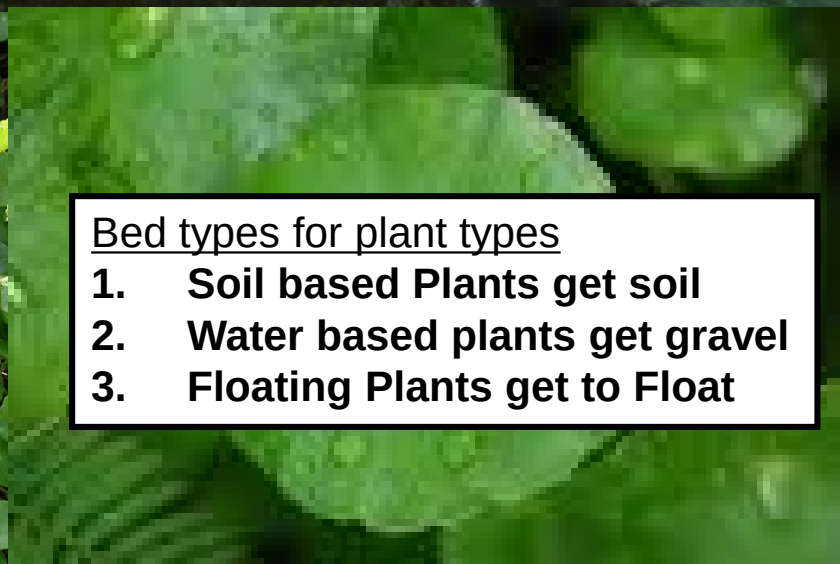
Water Loving Plants

Gotu kola (Centella asiatica)
Viola
All of the Mints
Wasabe (*Wasabia japonica*, *Cochlearia wasabi*, or *Eutrema japonica)*
Dandelion (Taraxacum officinale)
Nasturtium

Equisetum hyemale
[Horsetail, Scouring Rush]







Bed types for plant types

1. **Soil based Plants get soil**
2. **Water based plants get gravel**
3. **Floating Plants get to Float**

Nitrate loving leafy greens

Simulated river bed

Soil based

Aquaponics

Gotocola

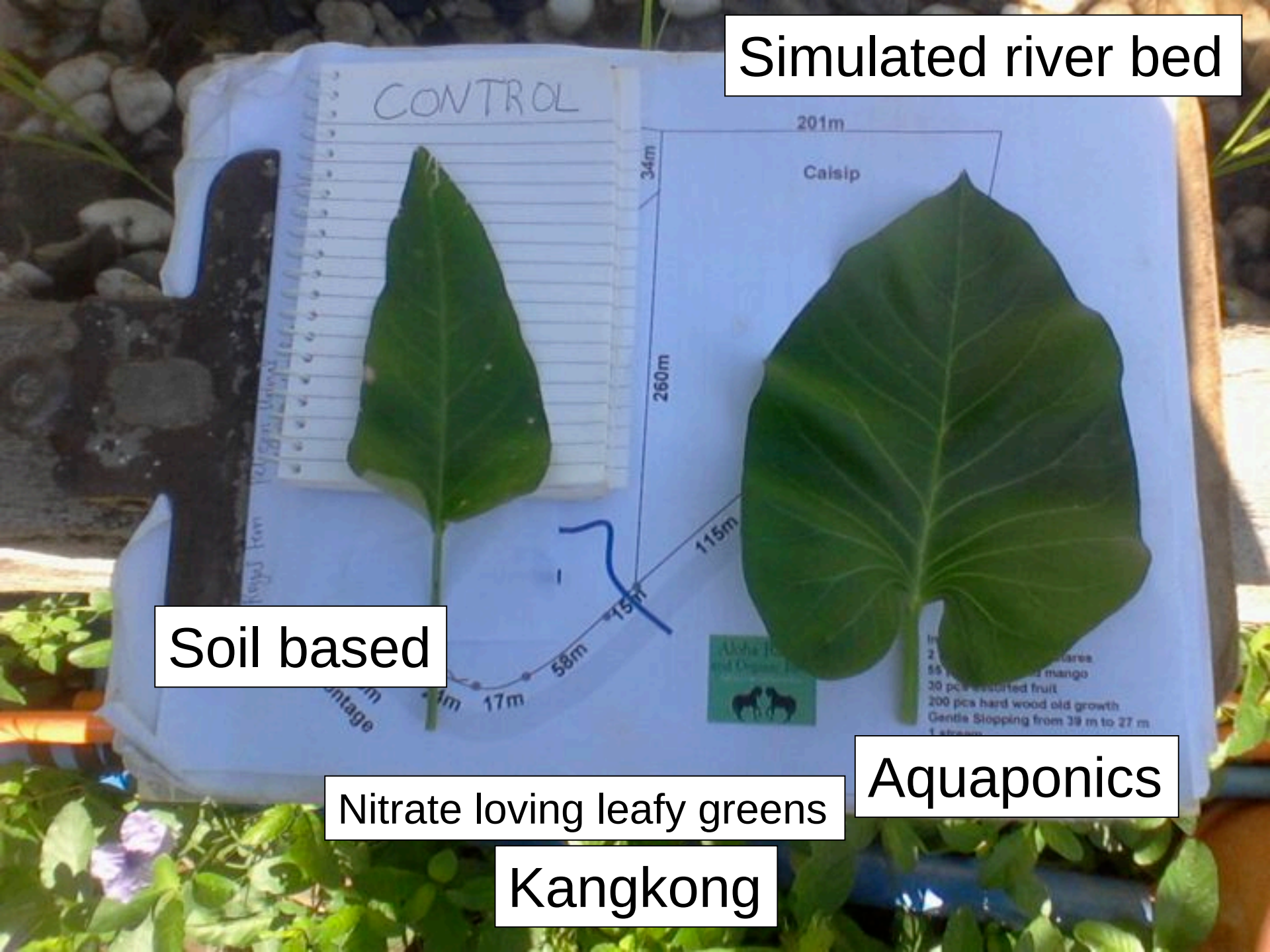

Water LILY
Salvinia molesta
[Giant Salvinia, Water Fern, Kariba Weed]


Water Loving Plants
Gabi, Poi, taro

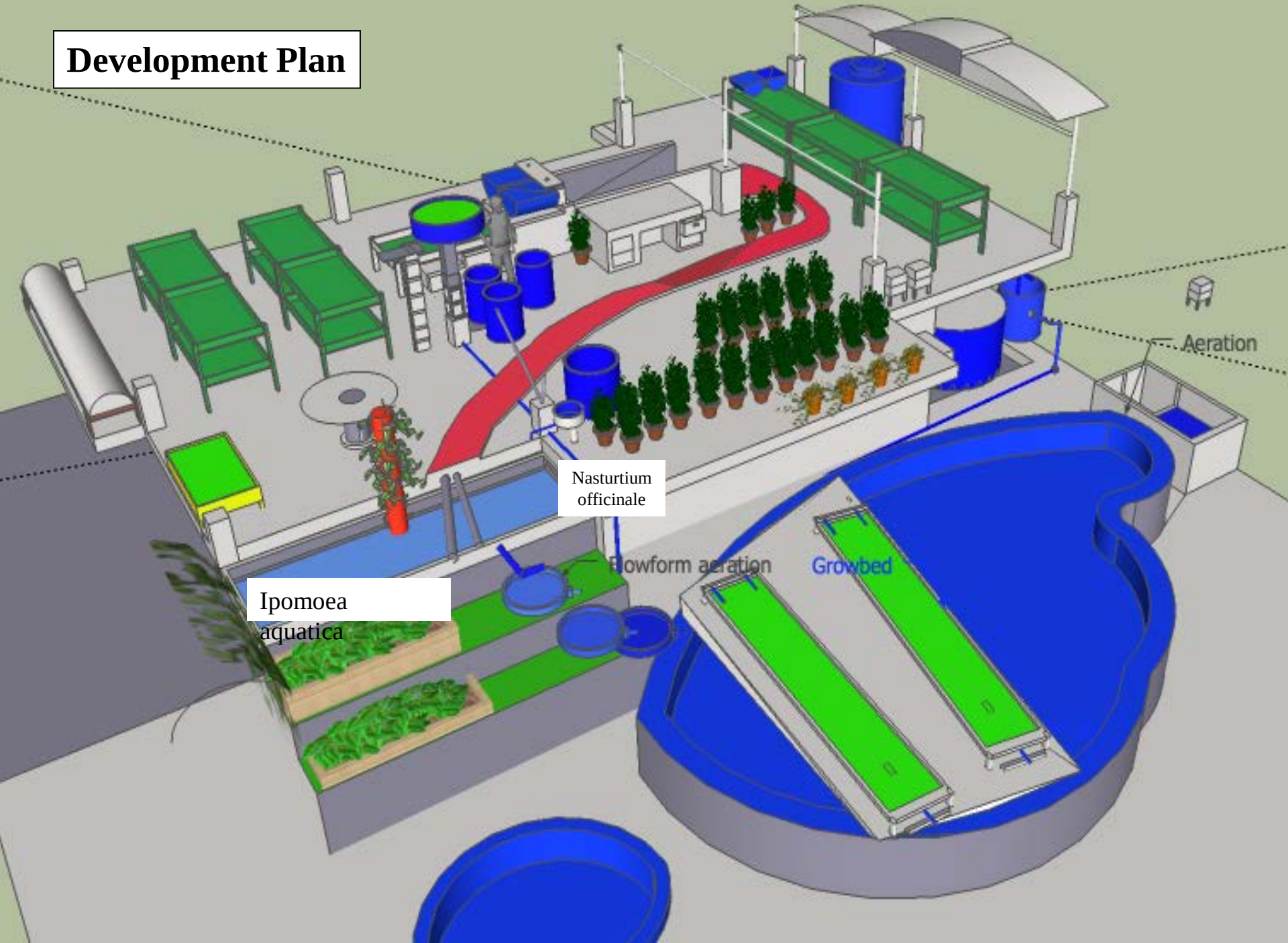
Nasturtium Flowers
Water cress *Nasturtium officinale*


Gabi
CB3


Kang
Kong
CB4


Simulated river bed
CONTROL
201m
34m
Caisip
260m
115m
58m
17m
Soil based
Aquaponics
Nitrate loving leafy greens
Kangkong

Development Plan




Strawberry Tower
W/ Centella asiatica


Eichhornia crassipes
Water hyacinth
Non fish feed
Oxygen producing
Floating Plants


Predator Insect Habitat
Oxygen producing
Floating Plants
Eichhornia crassipes
Water hyacinth


Harvesting Fishes
Selective harvest

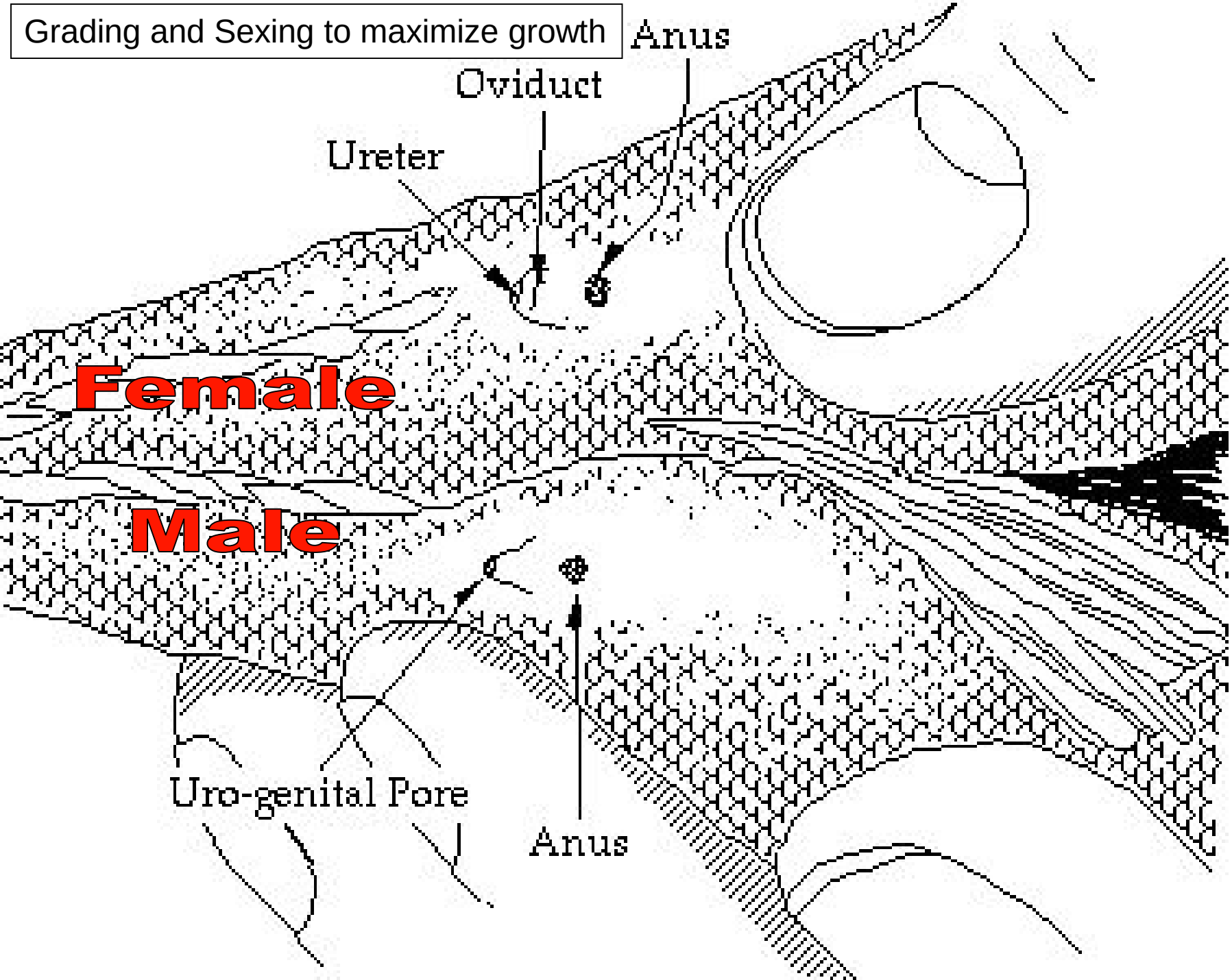

Selective harvest


The maximum biomass of fish a system can support without restricting fish growth is called the critical standing crop.
Harvesting Fishes
Complete harvest


Complete harvest


Selective harvest

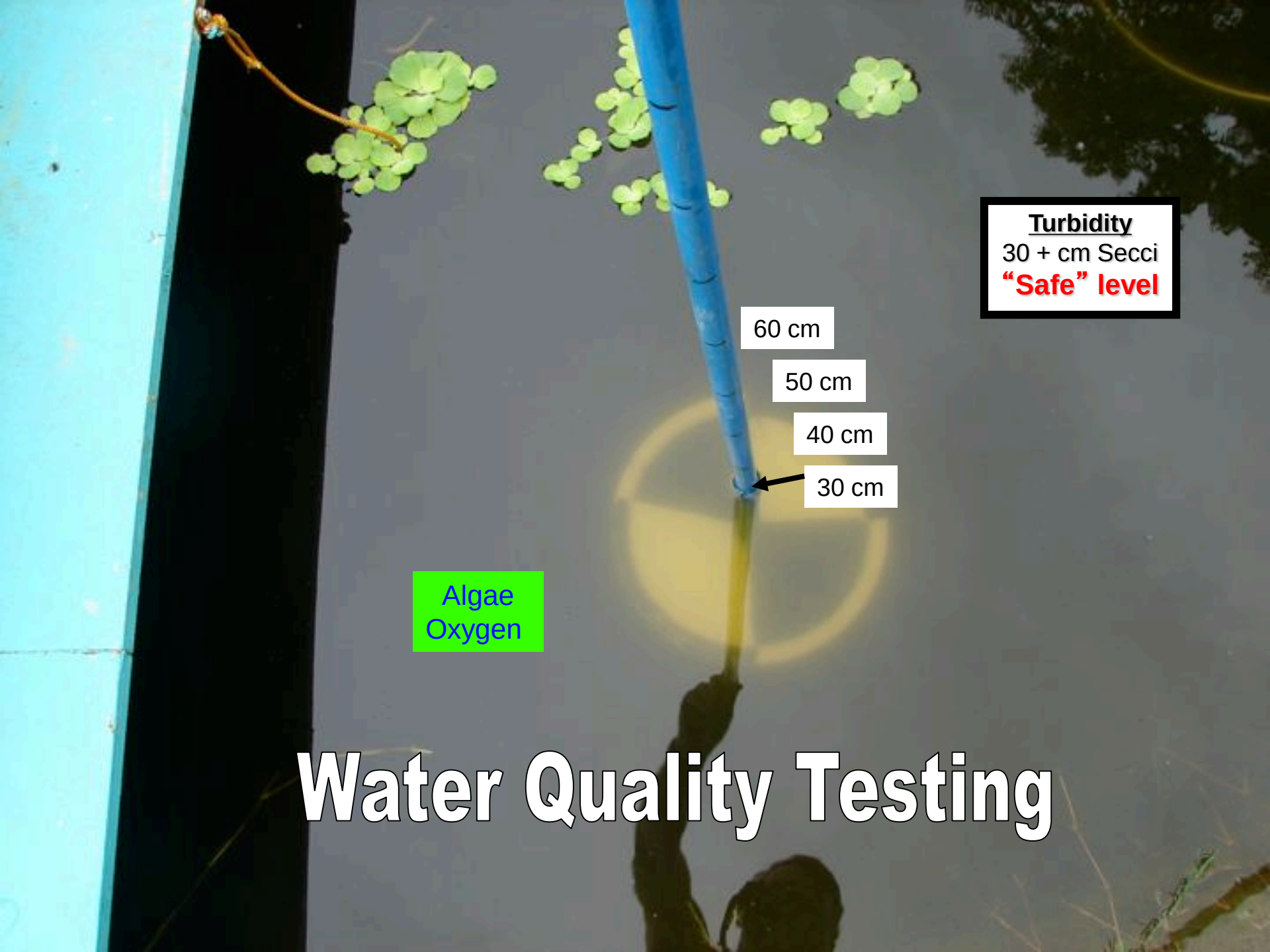
Grading and Sexing to maximize growth

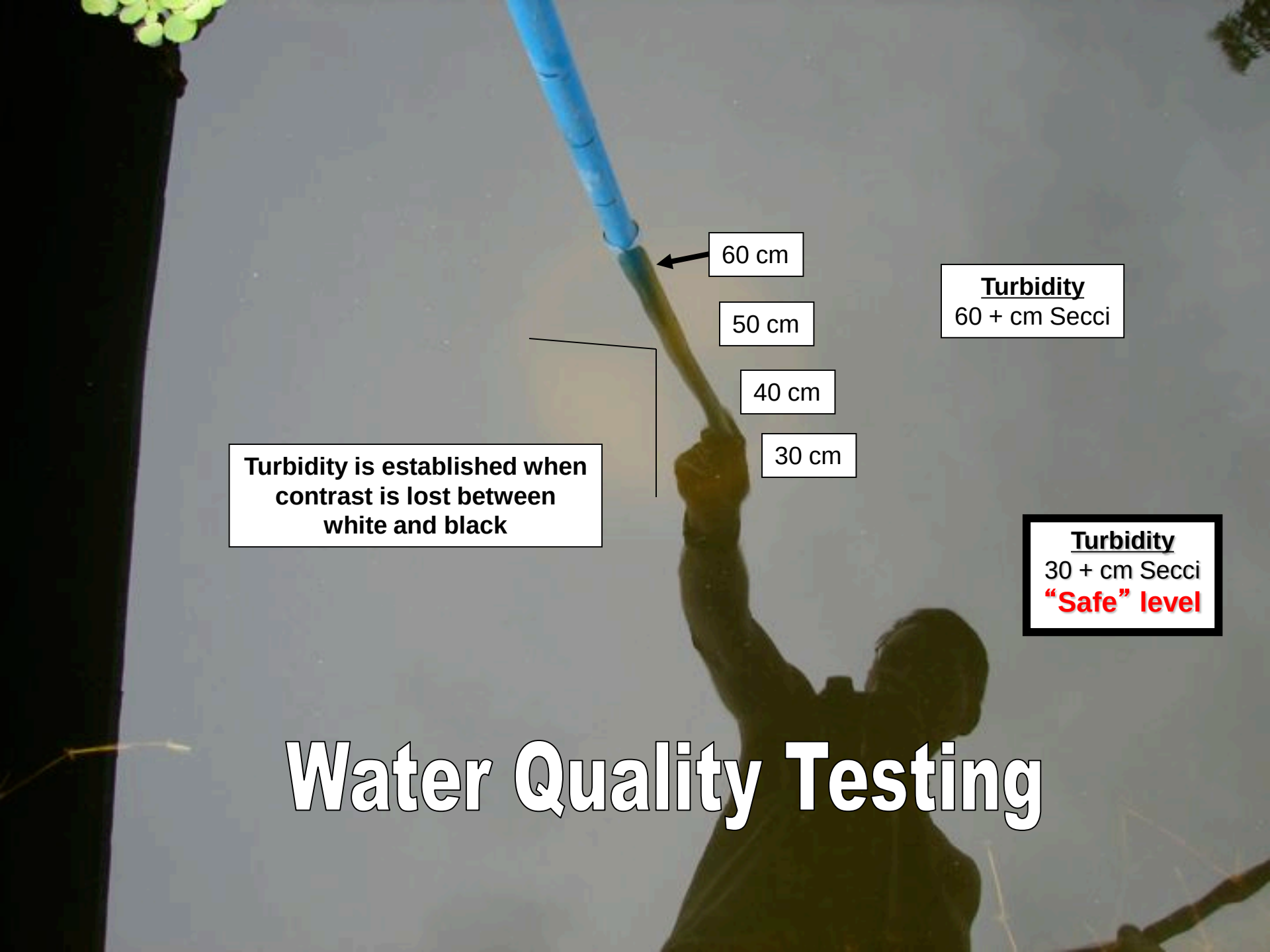


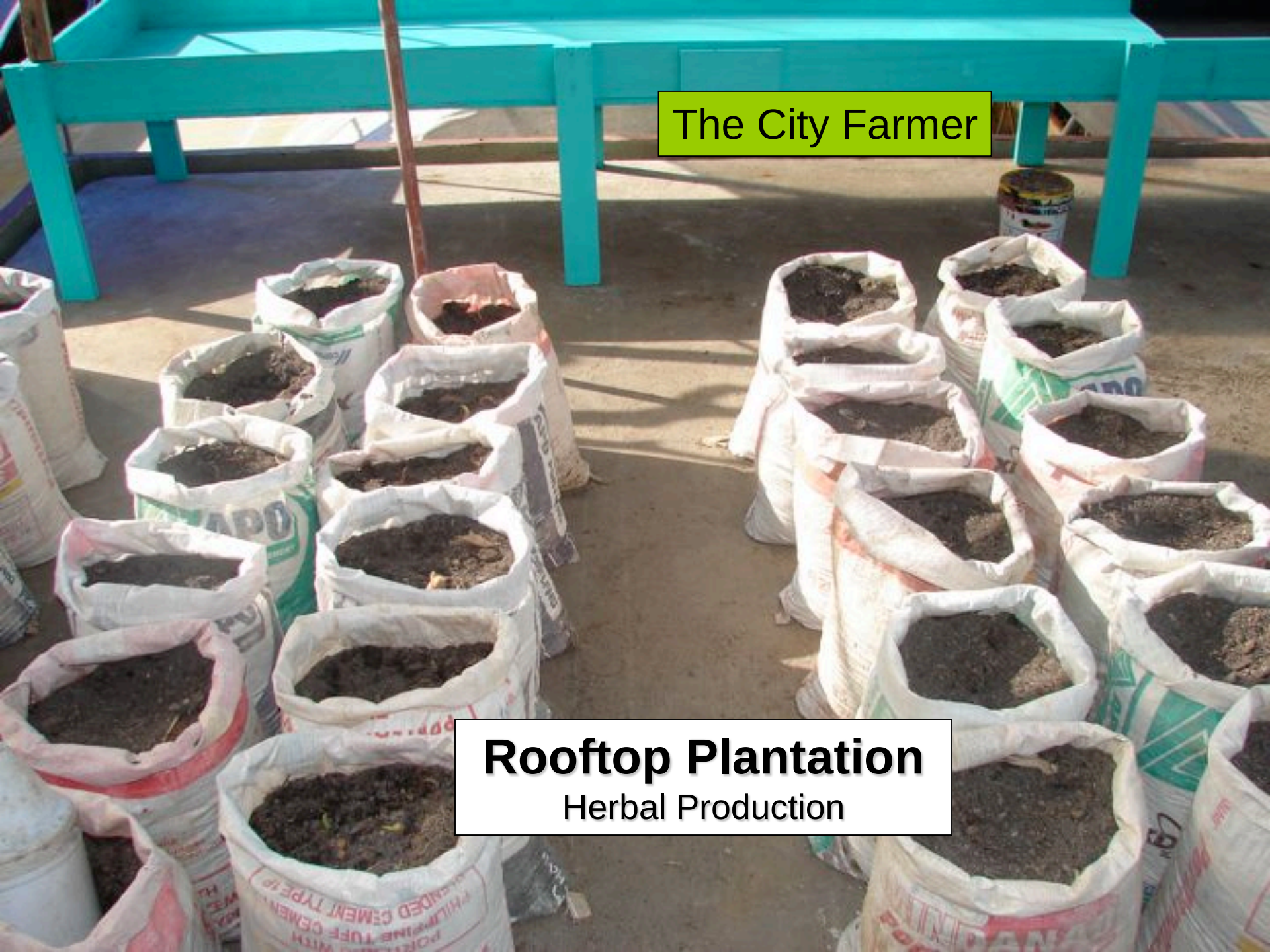
Grading and Sexing to maximize growth

Consumption

Water Quality Testing


Turbidity
30 + cm Secci
"Safe" level
60 cm
50 cm
40 cm
30 cm
Algae
Oxygen
Water Quality Testing


60 cm
50 cm
40 cm
30 cm
Turbidity
60 + cm Secci
Turbidity is established when contrast is lost between white and black
Turbidity
30 + cm Secci
“Safe” level
Water Quality Testing


The City Farmer
Rooftop Plantation
Herbal Production


The City Farmer
Rooftop Plantation
Herbal Production


The City Farmer
Rooftop Plantation
Herbal Production


The City Farmer
Hanging plants
Maximize space
Rooftop Plantation
Hanging Plants
Herbal Production

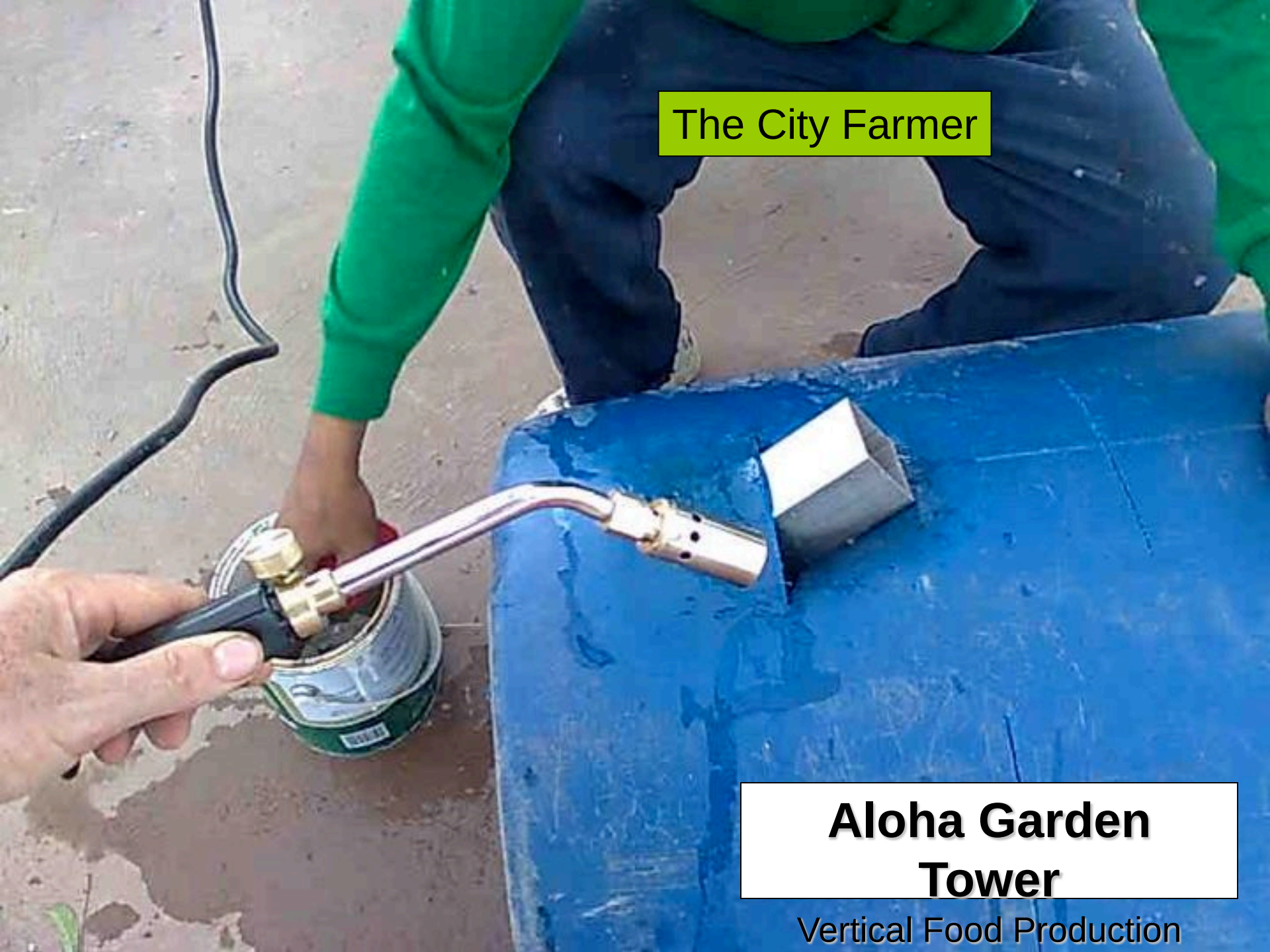

The City Farmer
Aloha Garden Tower
Vertical Food Production

Aloha Garden Tower

Vertical Food Production

Aloha Garden Tower

Vertical Food Production


The City Farmer
Aloha Garden Tower
Vertical Food Production


The City Farmer
Aloha Garden Tower
Vertical Food Production


The City Farmer
Aloha Garden Tower ©
ALOHA HOUSE
ALOHA HOUSE
Aloha Garden Tower
Vertical Food Production

Aloha Garden Tower

Vertical Food Production

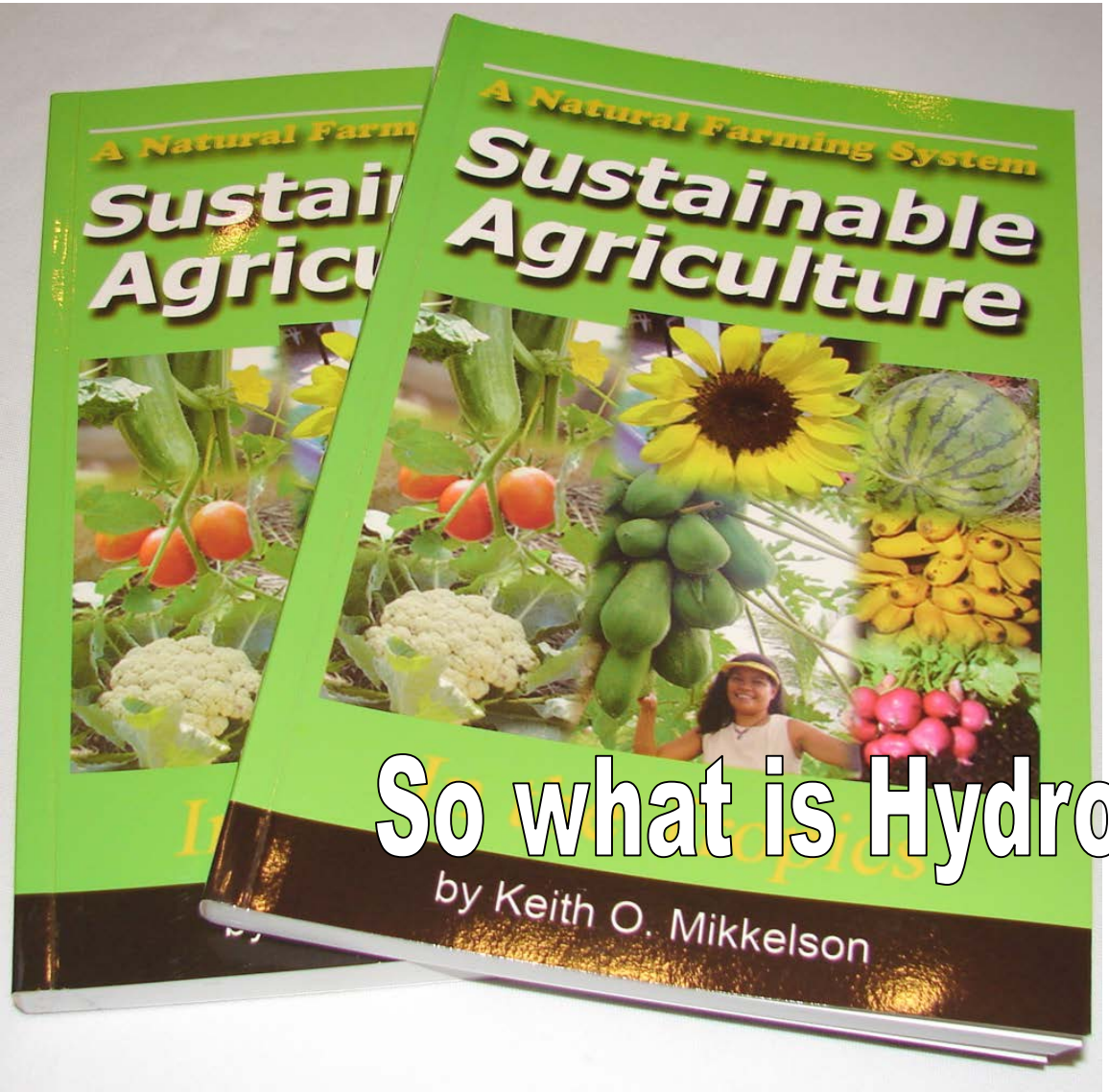
Aloha Garden Tower


Aloha Garden Tower
Vertical Food Production

Aloha Garden Tower

Vertical Food Production

RESOURCE RECOVERY FOR THE PRODUCTION OF HIGH QUALITY NUTRIENT DENSE FOOD AND MAXIMUM HEALTH

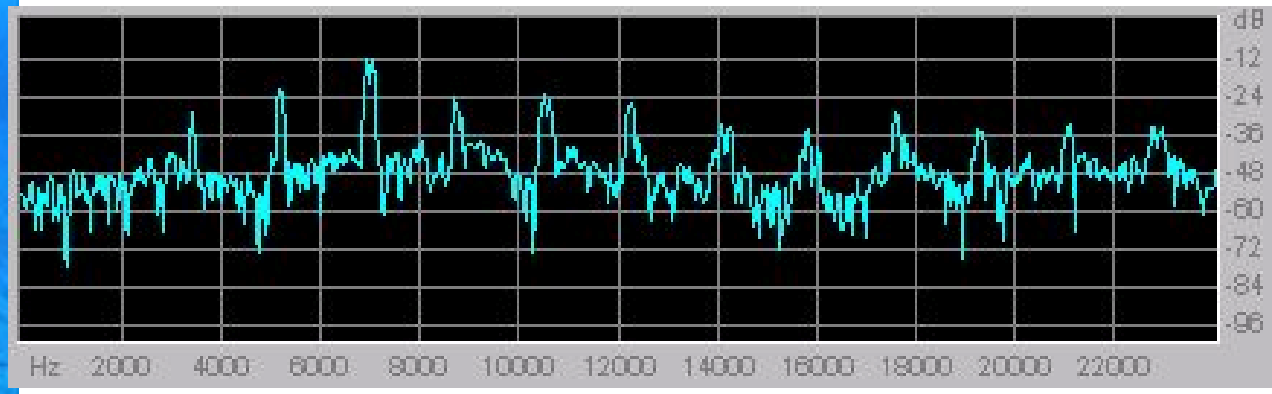


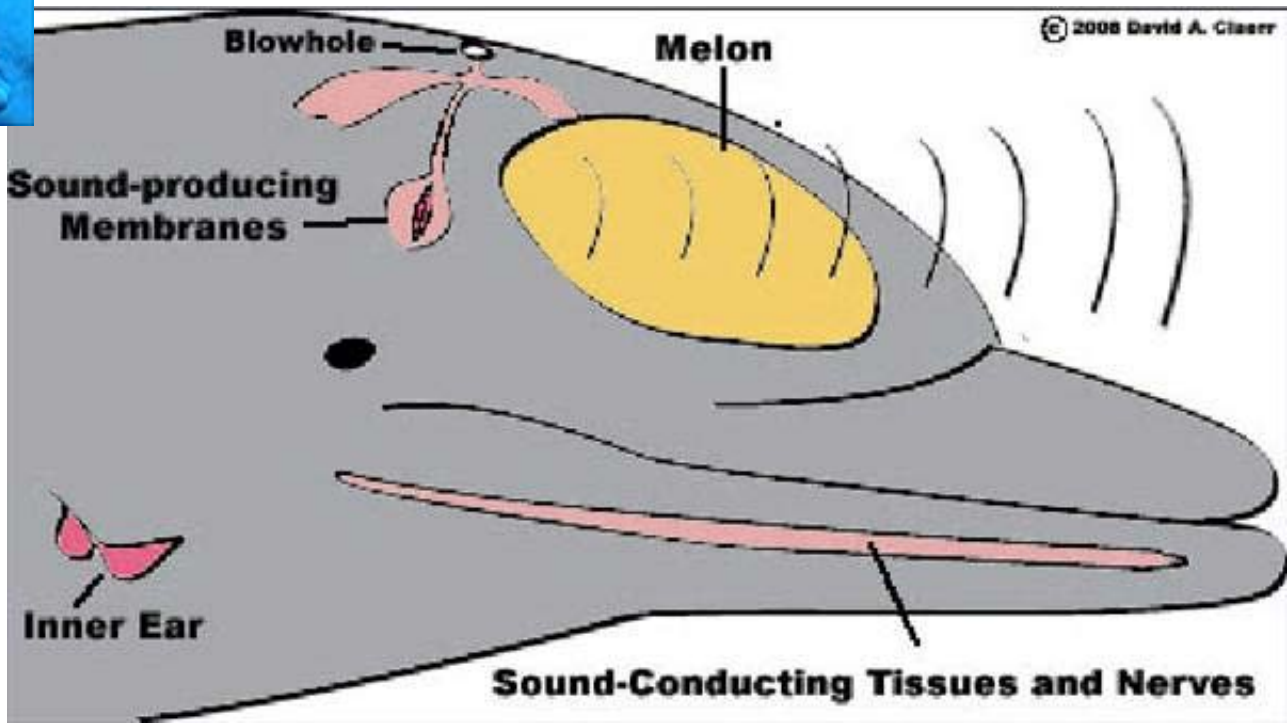
A Natural Farming Method for
Sustainable Agriculture
in the Tropics

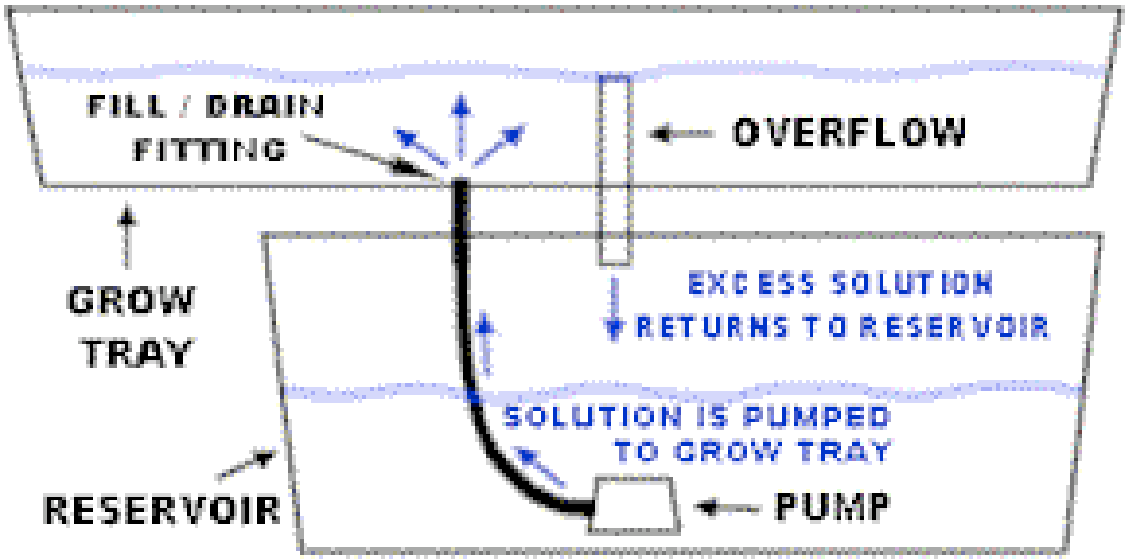
By Keith O. Mikkelson
mik@mozcom.com

So what is Hydroponics?

Hydrophonics



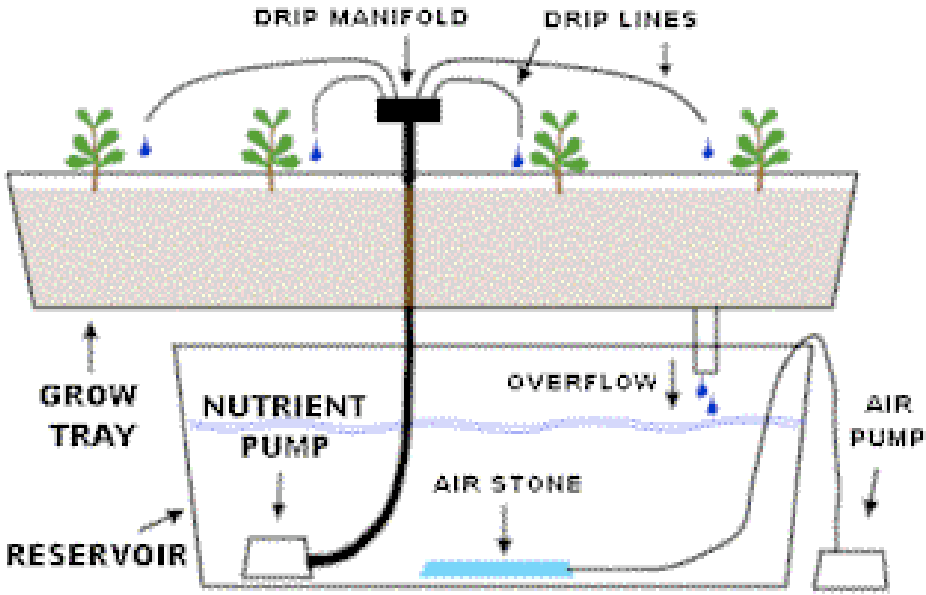




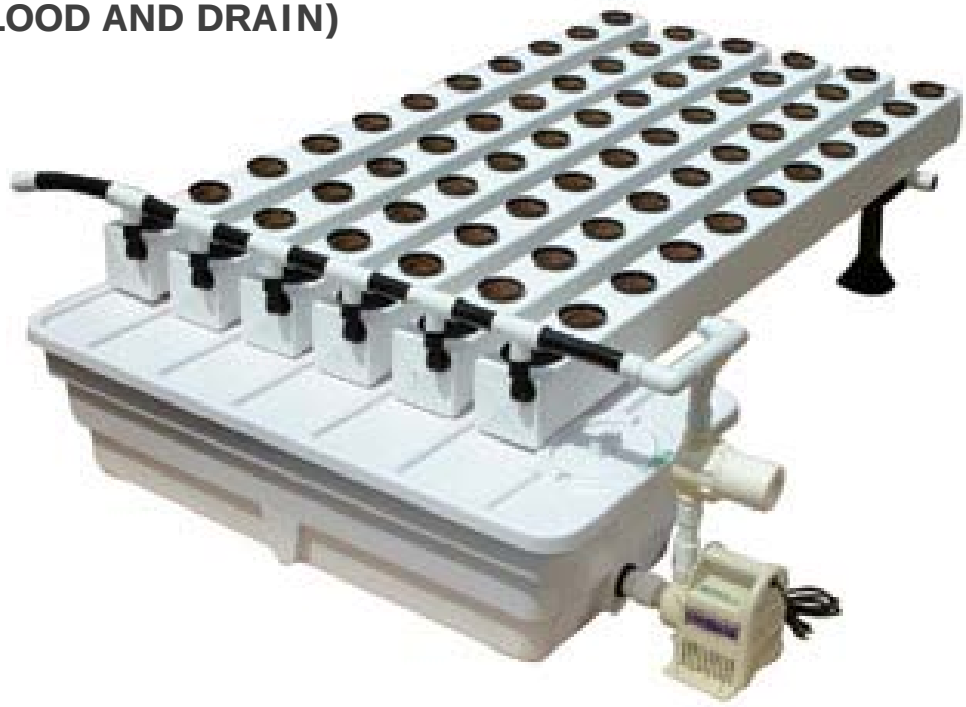
FLOOD / FLOW CYCLE (PUMP ON)

Hydroponics usually is a soil-less growing technology for fruits and vegetables using water and soluable fertilizers

Types of Hydroponics



EBB & FLOW - (FLOOD AND DRAIN)



WICK SYSTEM

WATER CULTURE

AEROPONIC

DRIP SYSTEMS
RECOVERY / NON-RECOVERY

N.F.T.
(Nutrient Film Technique)

Criticism of Hydroponics

1. Technologically Advanced
2. Management Intensive
3. Can you find a system in operation for over 1 year?
4. How about 5 years old?
5. Often Exotic Imported Mediums
6. Nutritionally lacking…

MEDIUMS: The seedling / plants are not placed into the soil. Instead alternative natural medium from mother earth is used as described below. The medium once used can be returned back into the recycling system of nature. and after the medium is returned back into the earth recycling system it also becomes environmentally friendly.

Rock Wool: This is made from Basalt rock (volcanic rock) which when **heated to over 1600 deg** it goes back to its original formation as volcanic lava. It is then **spun in a chamber** that creates fine light weight fibers. Rock wool is ideal for hydroponics as it retains excellent water as well as helping towards supplying oxygen to the roots of the plants via their loose fiber. Rock wool is also recyclable.

Organic Potting Mix: This potting mix is **imported in from Europe**. The P.H level has been adjusted to a neutral level with limestone. 98% certified as Organic. This potting mix is widely used throughout their herb range.

Coco Coir: Friendly Coco Coir Peat is the coir fiber pith **produced as a bi-product** when coconut husks are processed for the extraction of long fibers from the husk. Coco Coir Peat is the binding material that comes from the fiber fraction of the coconut husk. It can hold up to 8 times its own weight in water.

Perlite: is a naturally occurring siliceous rock when **heated** to an appropriate temperature it expands up to 20 times its original size. It is light weight, sterile non-toxic.

Criticism of Hydroponics

1. Technologically Advanced
2. Management Intensive
3. Can you find a system in operation over 1 year?
4. How about 5 years old?
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6. Nutritionally lacking…

Nutritional proof lacking: Claims only

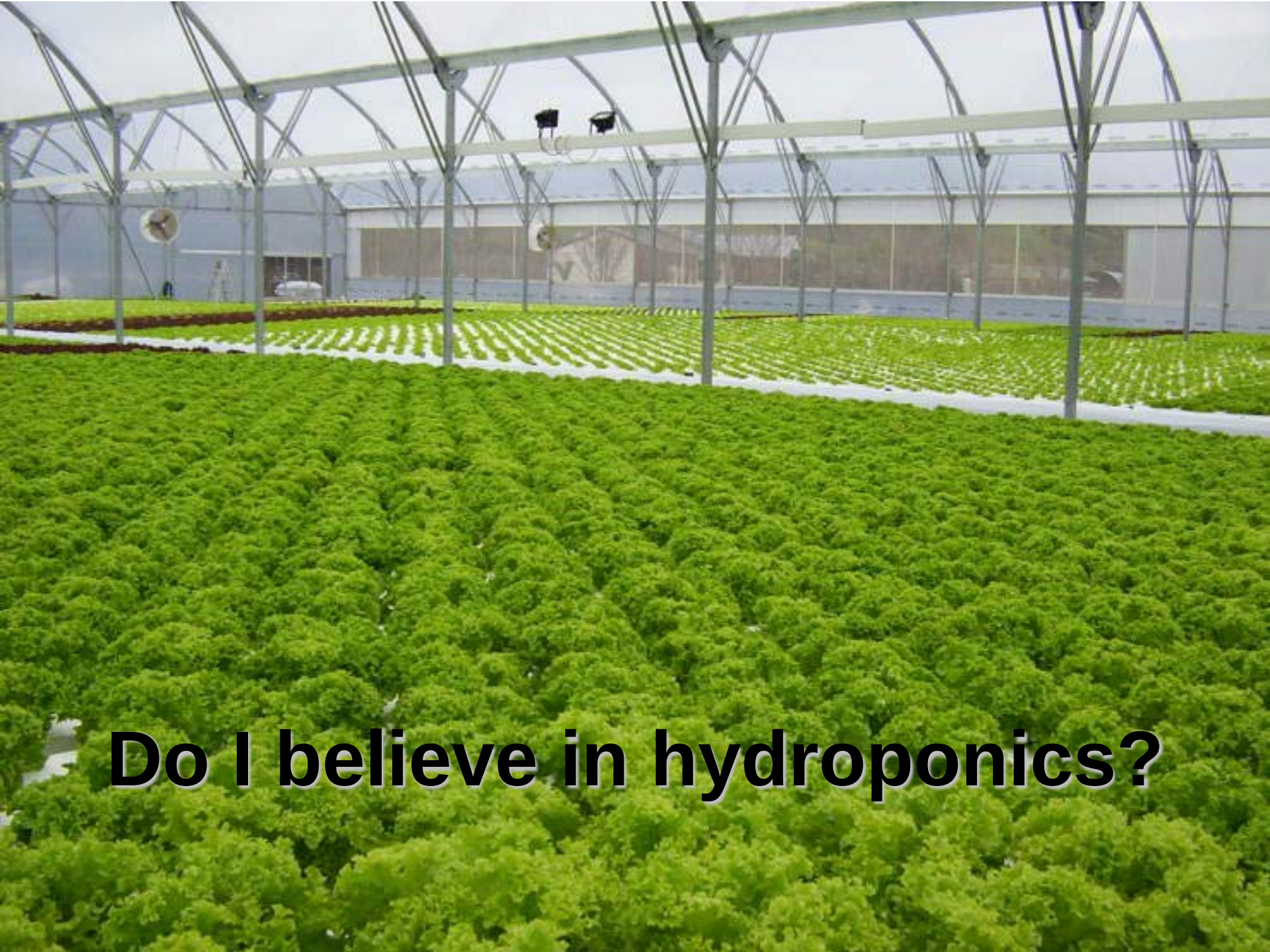
With intensive use:
Water gets worse not better…
Soil gets better, not worse

Terra Firma!

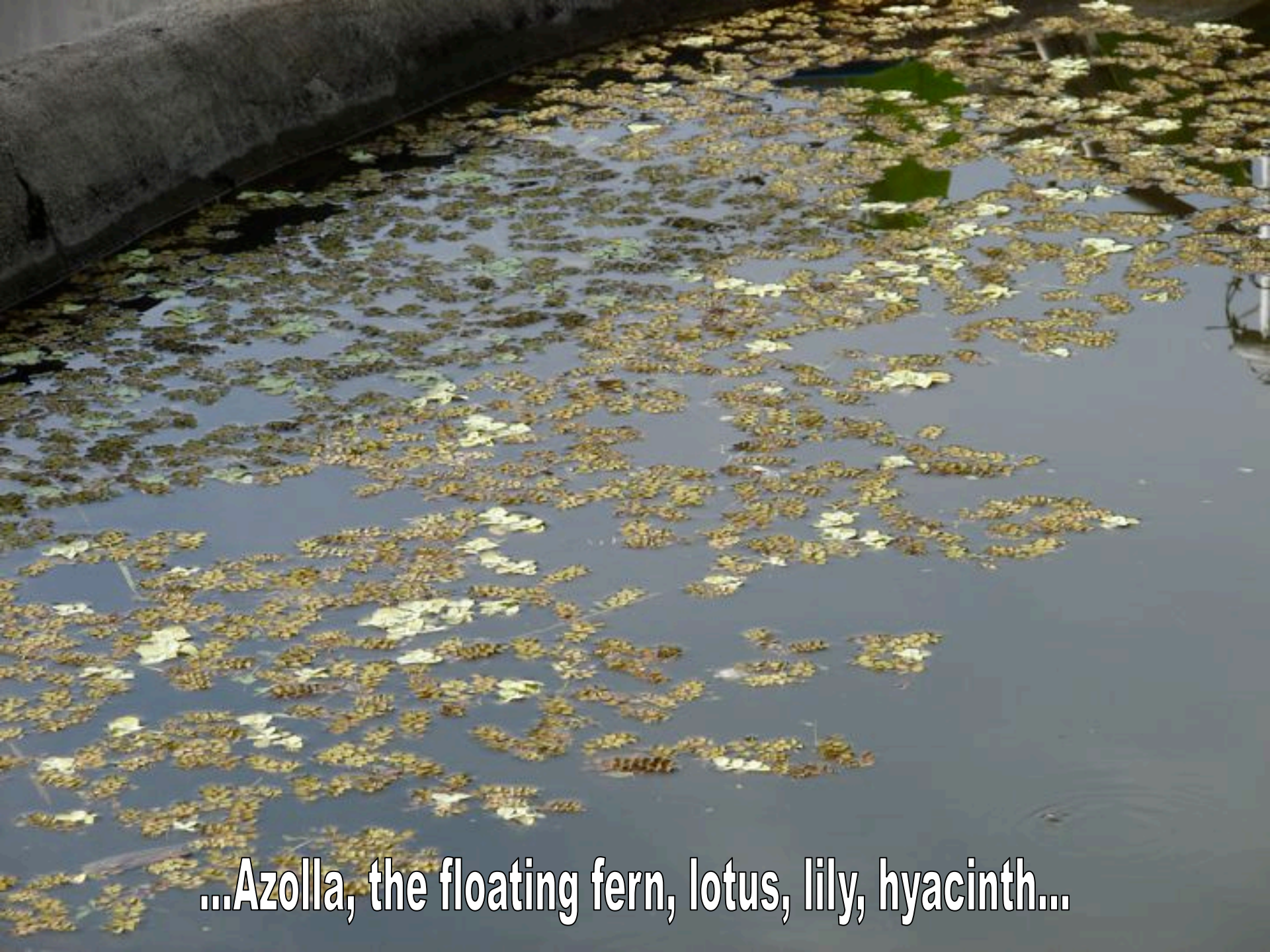
Hydroponic Farming Eliminates The Soil

	Traditional Farming	Emirates Hydroponics Farms	Water saving / kg yield
Lettuces	320 Gallons	10 Gallons	310 Gallons
Tomatoes	360 Gallons	12 gallons	348 Gallons
Strawberries	370 Gallons	54 Gallons	316 Gallons

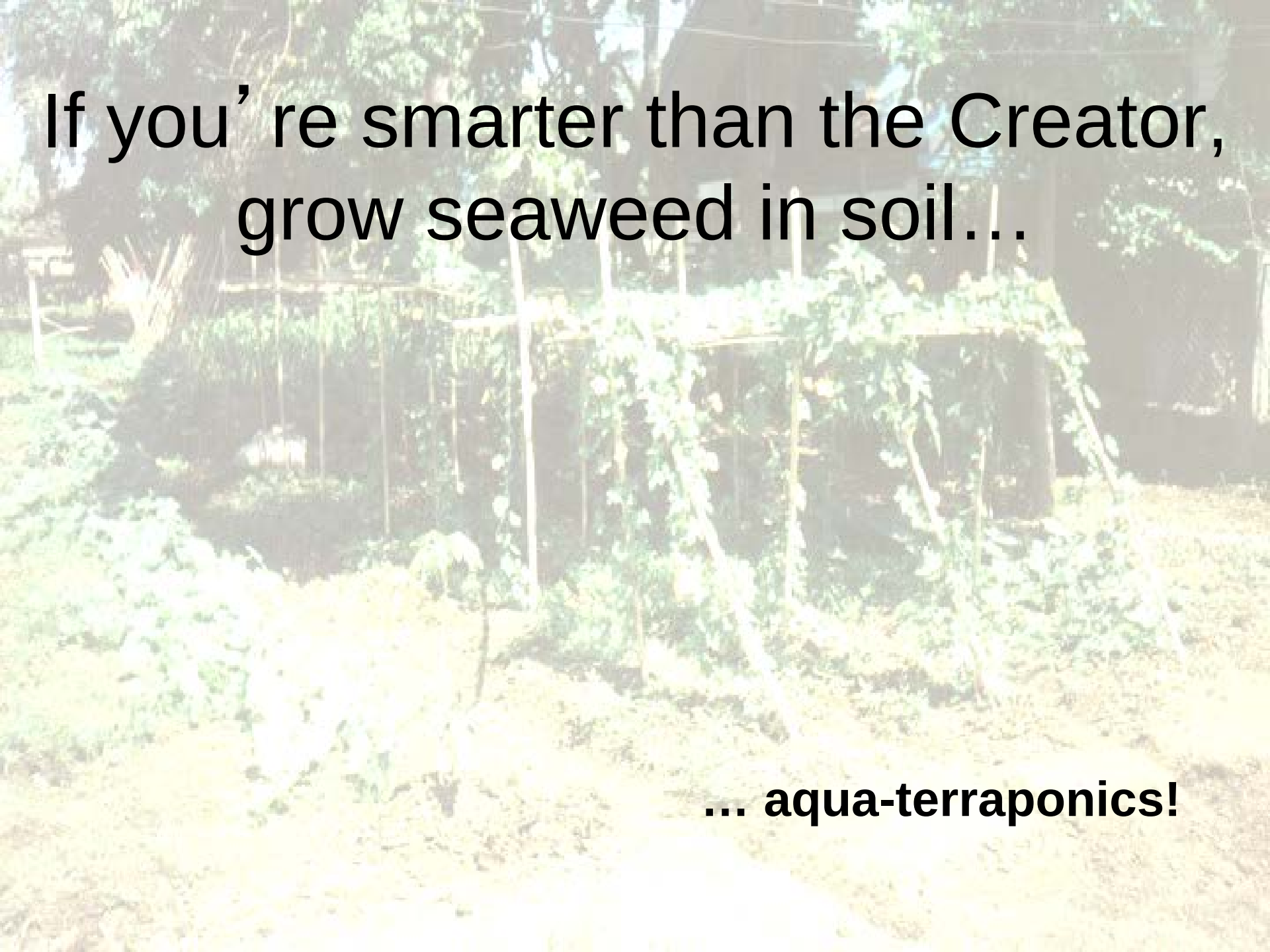
Then God said, **"Let the land produce vegetation:** seed-bearing **plants and trees on the land** that bear fruit with seed in it, according to their various kinds." And it was so. **12** **The land produced vegetation**: plants bearing seed according to their kinds and trees bearing fruit with seed in it according to their kinds. **And God saw that it was good.** **13** And there was evening, and there was morning, the third day.


Do I believe in hydroponics?


Do I believe in hydroponics?
Why not?
God invented it...
...it's called seaweed, kelp and algae!


...Azolla, the floating fern, lotus, lily, hyacinth...

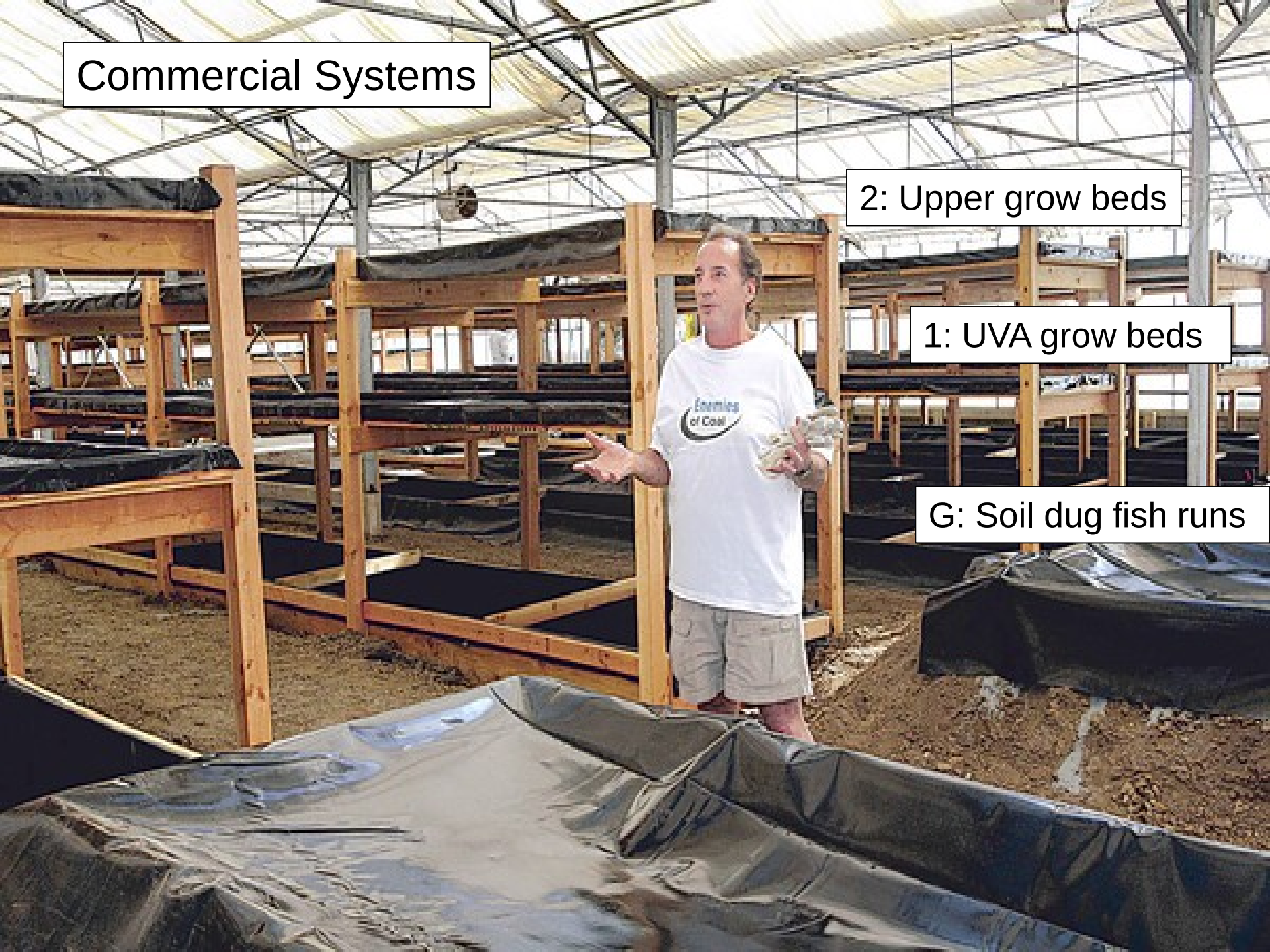

Designed to
live in water!
...Azolla, the floating fern, lotus, lily, hyacinth...



If you're smarter than the Creator, grow seaweed in soil…

… aqua-terraponics!


Commercial Systems
2: Upper grow beds
1: UVA grow beds
G: Soil dug fish runs


Commercial Systems
2: Upper grow beds
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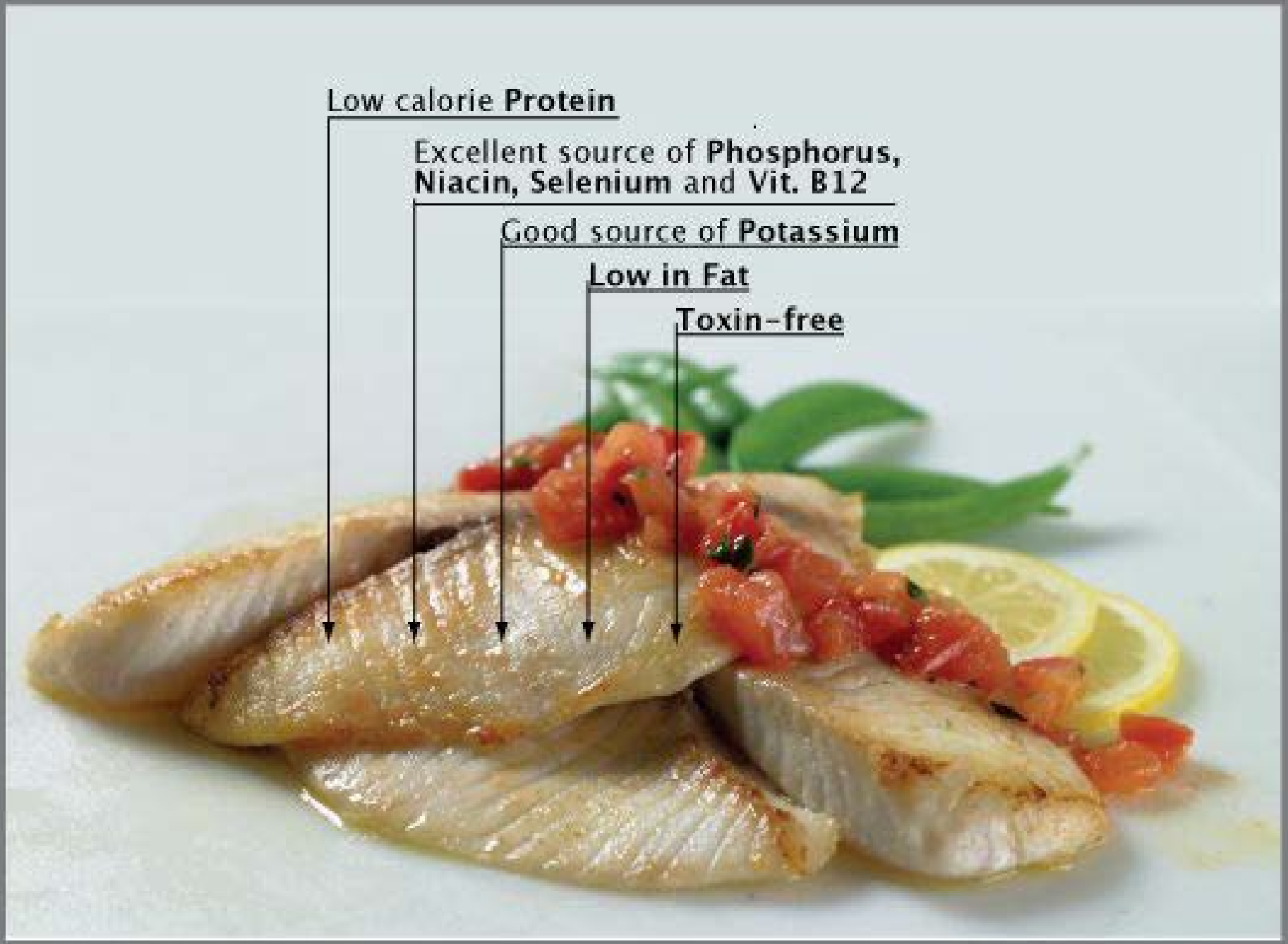
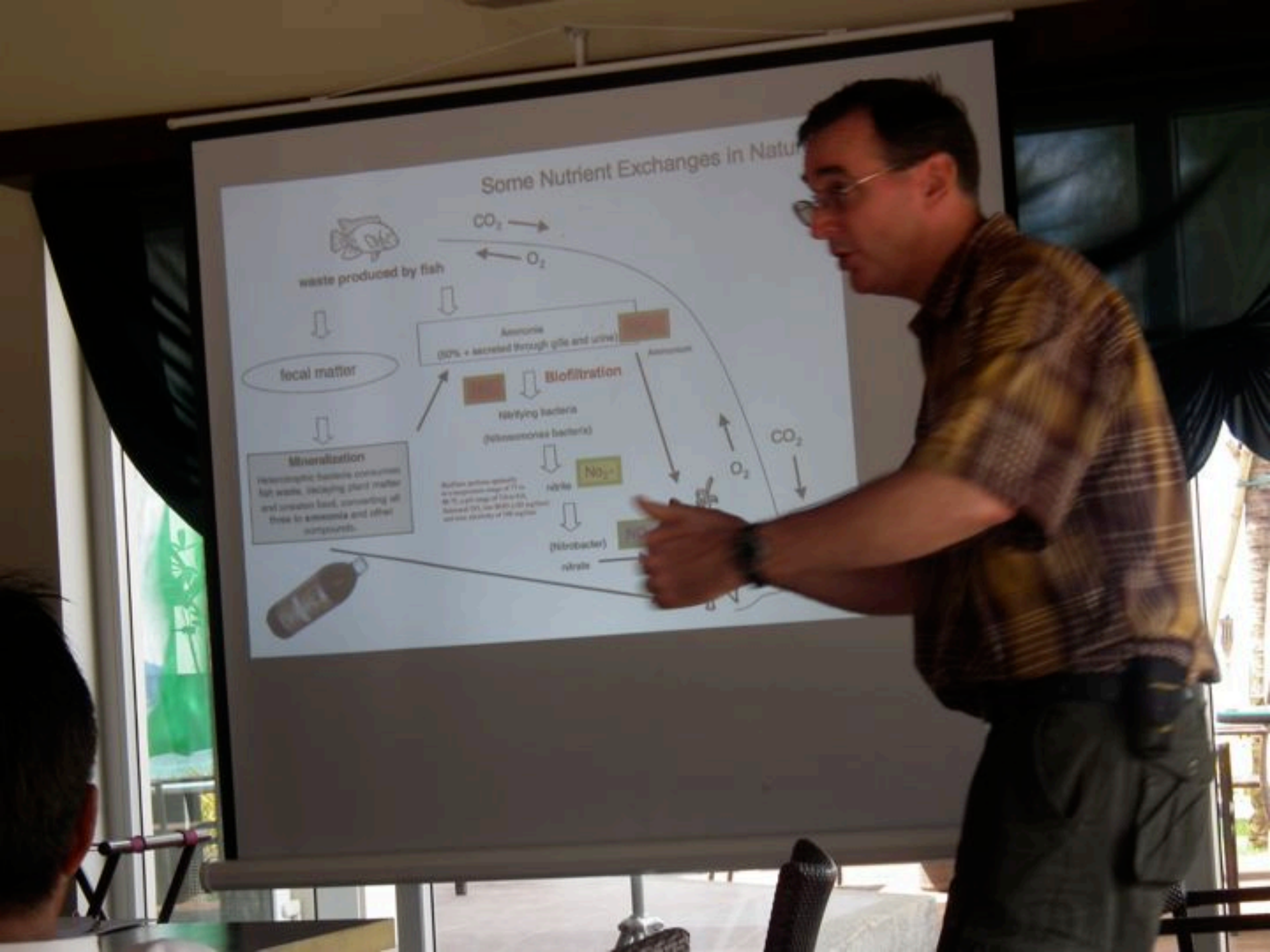
Commercial Systems

Commercial Systems

Commercial Systems


Low calorie **Protein**
Excellent source of **Phosphorus, Niacin, Selenium** and **Vit. B12**
Good source of **Potassium**
Low in Fat
Toxin-free


Some Nutrient Exchanges in Natu
CO_2
O_2
waste produced by fish
fecal matter
Biofiltration
nitrifying bacteria
(Nitrosomonas bacteria)
Mineralization
nitrite
NO_2^-
(Nitrobacter)
nitrate
O_2
CO_2


Whoops...


Consultant
General Manager
Chief Engineer

Commercial Systems

$6,000.00

Murray Hallams Practical Aquaponics

Single family size

- One lettuce tray (1.2 X 2.4 m)
- One fish tank (200 L)
- One small air pump
- Shade cloth

Other designs are permissible as long as the basic specifications are followed. In this instance fish are under the plants, water flows constantly, etc.

Specifications

•Water transfer, manual
•Fish biomass, about 2.5 kg
•Daily feed, 40-59 g
•Iron chelate, 0.25 g/week
•1.4 heads lettuce/day; 1.8 kg tilapia/10 weeks
•Cost, 250 USD

Micro-farm size

Components

- 8 linked lettuce trays
- one 1600 L fish tank
- one air blower
- water pump
- Shade cloth (50%)

Specifications

- stock about 19.2 kg of fish
- feed 0.32-0.47 kg/day
- iron chelate 2 g/week
- annual production, 3300 heads of lettuce and 75 kg tilapia
- annual income about 8600 USD at Hawaii farm gate prices…ratio of lettuce to fish income
- cost of construction, 2500 USD

Small farm, 0.1 hectare

Components

- equivalent of 270 lettuce trays
- 54,000 L in tanks
- air blower
- recirculate water with a water pump

Specifications

- stock about 648 kg of fish
- daily feed, 11-16 kg
- annual production, 112,000 heads of lettuce, 2,500 kg tilapia
- Income 234,000 USD/year
- Cost, <80,000 USD

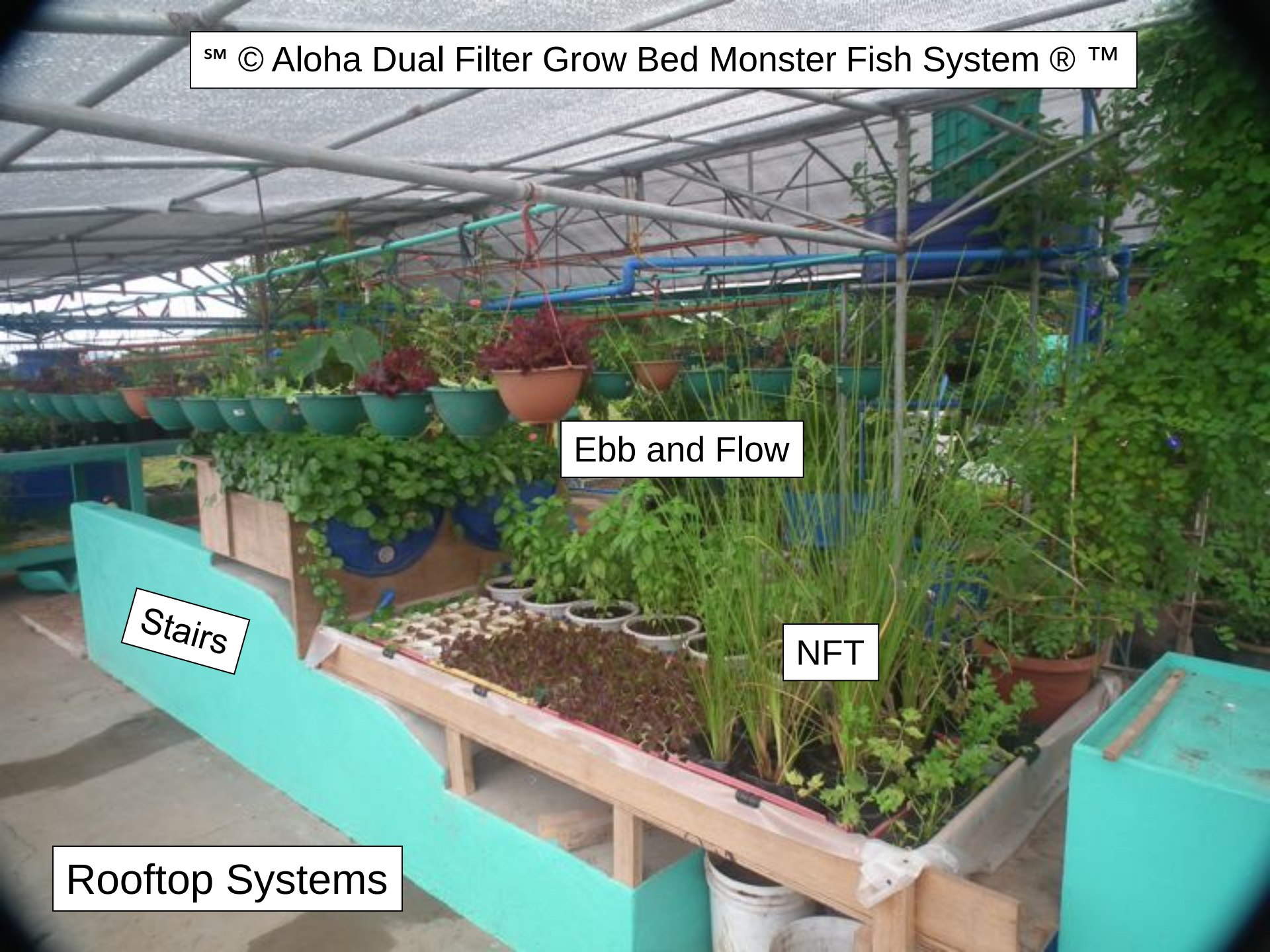
Cost: P40,000,000/h

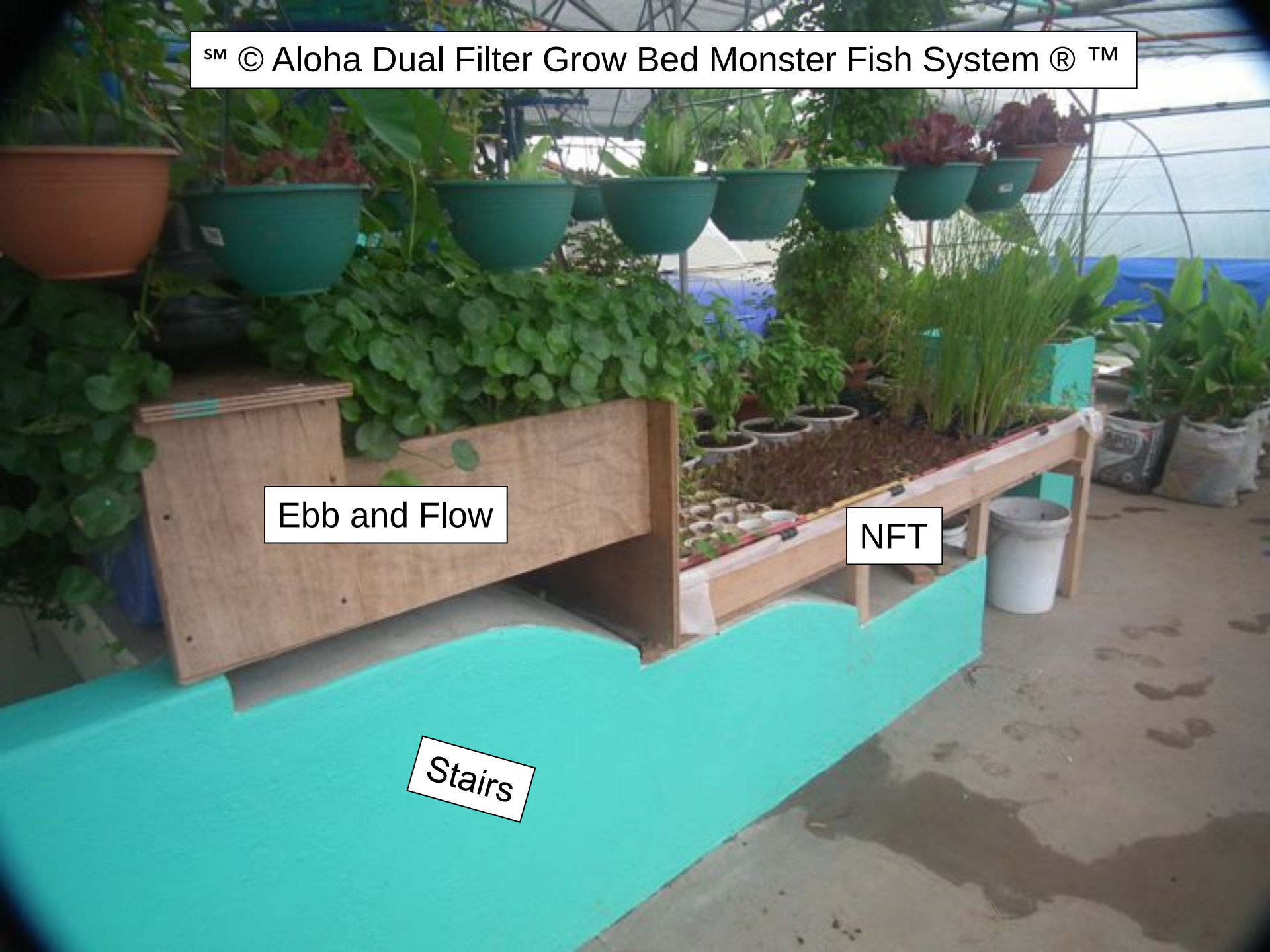
Thai Style Systems

Above:-
The walls are going up under the strict supervision of the head brickie, also known as 'she who must be obeyed'.

To the left of the grow bed is the submersible pump that we will use temporarily to flood the beds. I am in the process building a bicycle powered pump, a solar pump and a Servonius rotor pump.
We will try these out to see which option works best for us.


Home Systems


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™
Ebb and Flow
Stairs
NFT
Rooftop Systems


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™
Ebb and Flow
NFT
Stairs


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™
CHOPS
w/ venturi
Four 300 L grow out tanks
250 L water X 4 = 1,000 L
minimum

℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™

ENTER Stocking rate	plant grow area m^2	4' x 8' ($3m^{2)}$ beds	pond volume in liters	Pump Size @ 10' in hp
260	5.9	2	988	0.04

Minimum system


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™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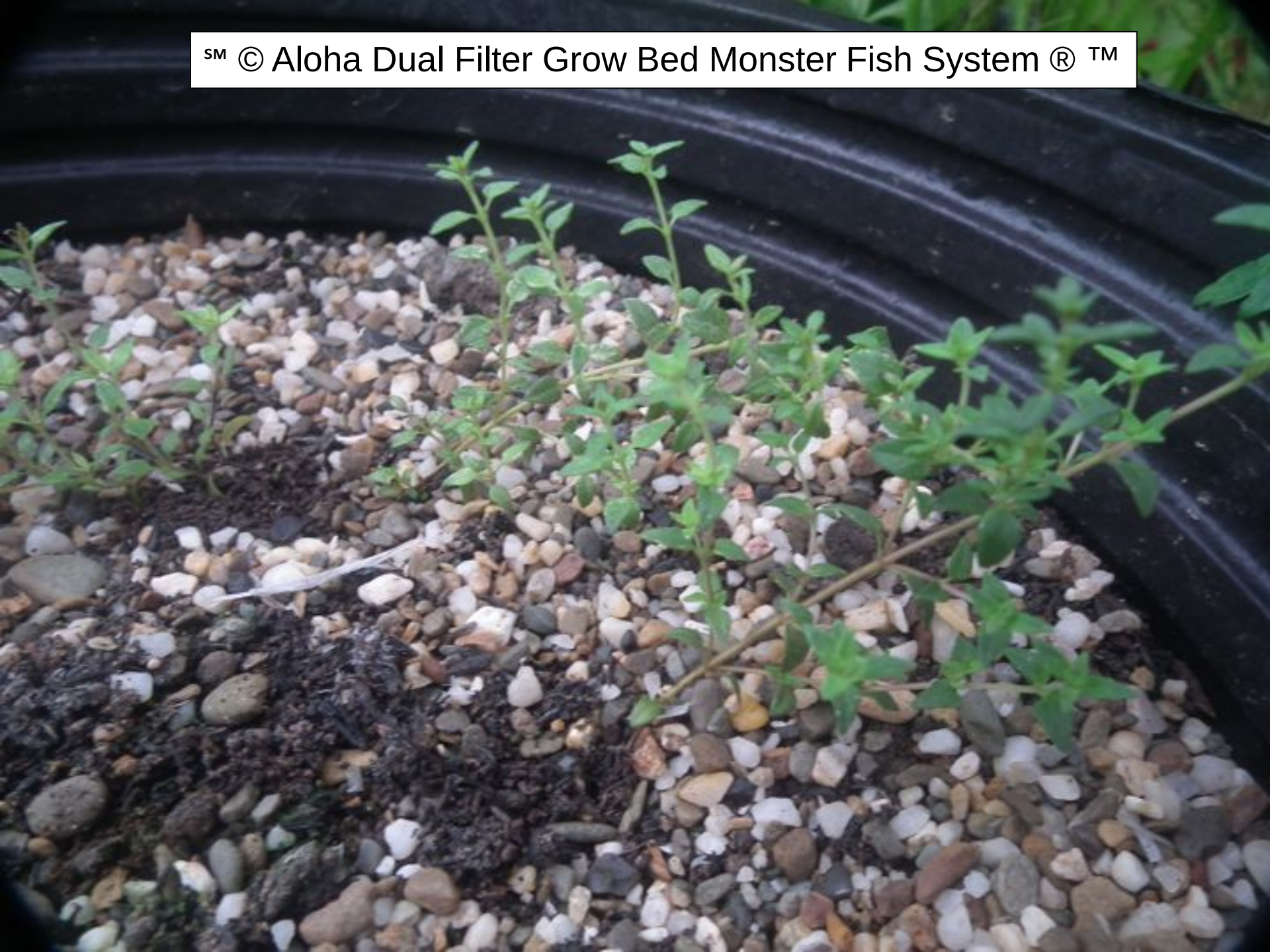
℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™


℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™
Don’t start with tomatoes


Thank You!

℠ © Aloha Dual Filter Grow Bed Monster Fish System ® ™

Planning your system

Location:_____ Climate:_____ Day length:_____hrs

Farm Area:_____ft^2 / m^2
Fish supplier:
Water source:
Economical non toxic feed:
Staffing:
Bed construction:

Pump sizing:

Filter medium:

Cultivar selection:

Aeration:

Tank sources:

Plumbing: