Lecture 6b

Integrated aquaculture

Water

- Scarce resource
- Increase in polluted water
- Decrease in clean water

Nitrogen (N) and Phosphorous (P)

- Needed for plant growth
  - Farmers add fertiliser

Nitrogen and Phosphorous

- Eutrophication
  - Cause eutrophication when released into environment
  - Algae use N and P to grow
  - Uncontrolled algal growth = use all oxygen = dead fish and bad water

Organic effluents – sources of nutrients and water

- Produced by breweries, sugar mills, aquaculture and agriculture

- Rich in N and P
- Could be used to grow crops

- Beneficiation - to add commercial value to what was considered "waste"

Organic effluents – sources of nutrients and water

- Use plants to remove dissolved N and P

- Clean water
- Plants can be used as an animal feed/human consumption
- Water available for reuse
- Reduce effluent disposal costs
- Generate income

The Ideal plant

- Efficient at nutrient removal
- Fast growth rate
- Economic value
- Used as an animal feed

Aquaponics






Aquaponics

- Aquaculture
  - Water replaced to reduce build up of N and P
- Aquaponics
  - Use plants to remove dissolved N and P

Aquaponics: 3 Basic types

Nutrient Film

- Grow plants in pipes where water is passed through

- Advantages
  - Good space usage
  - Commercial

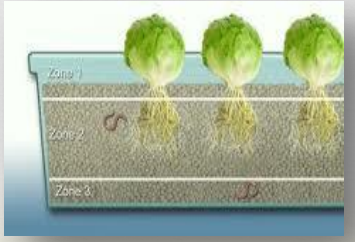
- Disadvantages
  - Plants dry out if power failure
  - Need sedimentation tanks

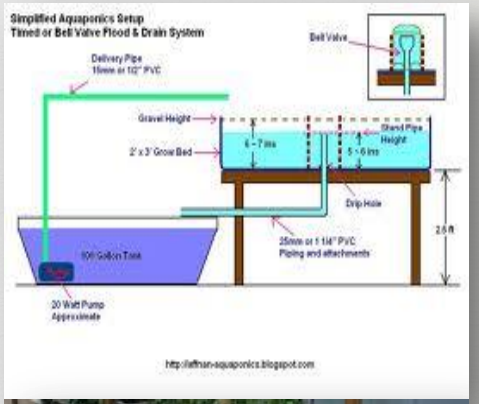
Ebb and Flow

- Fish tank water pumped into ebb and flow grow bed

- Advantages
  - No sedimentation tanks needed
  - Self aerating
  - Ideal for households
  - Robust – worms
  - If power goes out plants can survive

- Disadvantages ?





Deep Water Culture

- Grow plants in floating trays on water

- Advantages
  - Ideal for commercial
  - If power goes out plants will survive
  - Easy to set up and harvest plants
- Disadvantages
  - Need sedimentation tank
  - Aerate

Aquaponics

- Not as easy as it sounds
- Plants and fish require different conditions for growth
  - Add chelated iron
- Hard to treat diseases
- Rules of thumb
  - Grow bed volume = fish tank volume
- But it is possible and gaining momentum world wide

Duckweed: Nutrient removal

- Grew duckweed on brewery effluent
  - Efficient at nutrient removal
  - Removed > 85% of dissolved N and P in 12 days
  - Water was suitable for reuse and release into environment

Duckweed : Tilapia feed

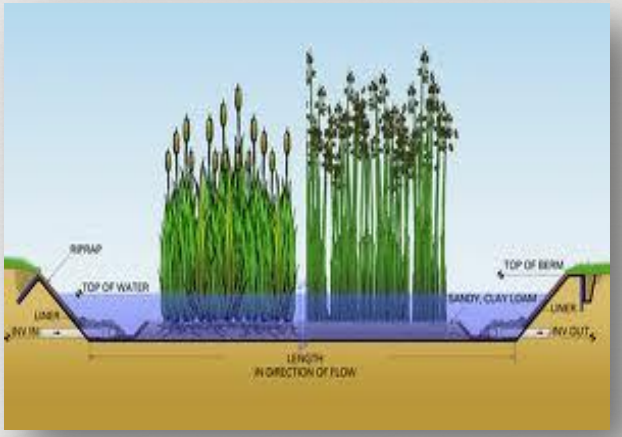
- Fed brewery effluent grown duckweed to tilapia

- Results
  - Brewery effluent grown duckweed cannot replace tilapia feed
    - Decrease in growth rates
  - Can replace 10 - 30% of tilapia feed with effluent grown duckweed
    - No decrease in growth rates

- Proof of concept
  - Nutrients in effluent → valuable plants → Protein

Constructed Wetlands

- Grow plants
  - Efficient nutrient removal
  - value
- Sell valuable plants/ use as an animal feed
- Grow fish in treated effluent
- Ideal for sugar mills
  - Have warm effluent needed for tilapia culture
  - Use fish to feed workers



What is happening globally

- Asia
  - Grow duckweed on agricultural effluent
  - Use it to feed chickens, pigs and fish

Need to see organic effluents as sources of nutrients

- Used to grow plants of economic value
- Decrease the negative impacts of effluent disposal
- Need to ensure enough water for human consumption
- Change the way industries deal with their effluent

Recycling nutrients

- Doesn't need to be complicated
  - Using chicken manure to fertilise crops
  - Sludge from fish farms: Catfish
  - Nutrient rich water from farms used as irrigation water

- It is the future
  - Using the suns energy to convert nutrients in effluent into valuable products
  - We need to find new ways to grow crops
  - Normal agriculture is not sustainable

Use discharge water from fish farm