# TDCJ MARK W. MICHAEL UNIT FIELD FORCE URBAN FARMING PROJECT



## Welcome

- What we hope to discuss is the following:
  - Differences between Hydroponics and Aquaponics
  - Cost associated with the different systems
  - The development of the systems within the Michael Unit. (Where we are at now.)
  - Community outreach projects we have completed with our system.
  - Possible futures with this project in relation to TDCJ and the community.

## Why Hydroponics or Aquaponics?

- Normal farm operations are changing throughout the US with new types of technology.
- Crops are now being developed within major cities such as Dallas, L.A., and New York.
- Taking ideas from inner city crop production we can develop crops from within the prisons to cut costs of operations.
- By having the production within the walls, less security is needed.

# What is Hydroponics and Aquaponics?

Hydroponics and aquaponics are a subset of hydroculture and are methods of growing plants using mineral nutrient solutions, in water, without soil.

## Hydroponics vs Aquaponics

#### Hydroponics:

- Uses a chemical nutrient solution to feed plants.
- Start up is low cost but maintaining the system can cost more than aquaponics.
- Nutrient solution can be tailored to specific plants.

#### Aquaponics:

- Uses the waste of fish to feed plants.
- High startup cost but lower maintained cost.
- General type of nutrient solution that can feed multiple types of crops.

# Hydroponics

- There are several different types of hydroponic systems.
- They rely on chemicals added to water to keep the system running.
- There are multiple ways to set up a system and a lot of the design is based on cost as well as materials that are available.

# Nutrient Film Technique

- This is the first system built for the unit.
- It is important to keep in mind the plants used in this system because root growth can cause clogs which effect the flow rate.
- Good flow rate for our system is 4 cups per minute.





# Ebb and Flood

The Ebb and Flood system is designed for plants that need a period of dryness to allow their roots to grow.

We cut a 30 gallon barrel in half to make our first ebb and flood system.



Nutrient solution returns to reservoir while system is not in operation



#### **Deep Water Culture**

- This is the system that most large scale operations use because of the ease of maintenance.
- We hope to install a system like this within a greenhouse so we can grow all year long.



## Michael Unit Hydroponics System

- When we started, we used a bathtub as the reservoir for water.
- We have learned a lot from trial and error.
  The latest system we built is much more like a commercial system.



# **Getting Started**

- When planning out for our first system we built a prototype in an old classroom that was not being used.
- Starting off with a bathtub to hold water we quickly realized that would not work and sank a IBC tote in the ground to replace it.







# Upgrading the System

Keeping security in mind we built a locking lid.
 As we came across issues with the system, we would build either an upgrade or work around it, such as suspending the grow tubes and putting up a sun screen during the summer.





#### Future Growth for the Michael Unit's Hydroponic System

- Keeping the system modular will allow the unit to expand to fit the needs of the unit.
- Keeping logs and notes we can help other units to develop their own systems, as well as help design systems based on a proven system.
- A properly run 2 acre greenhouse can produce the equivalent of 10 acres of field crops.







## Hydroponic Costs

Small start up cost – around \$600 to \$1000 for a smaller commercial system.

Non-Donated Parts:

- Water Pump \$60
- Air Pump with hookups \$100
- 6 month supply of chemicals \$70
- Net Cups \$30
- Grow medium \$40
- Donated Parts:
  - Grow Tubs PVC piping 3" and bigger
  - Water reservoir- IBC totes work great.

#### Aquaponics

- Aquaponics use fish waste instead of chemicals to feed the plants.
- Aquaponics rely on ecology to work and is vastly different on how it works compared to hydroponics.



### Michael Unit's Aquaponics System

- Hardest part to learn is how not to kill the fish.
- Can plant several different crops in the same system.
- Filter systems are the key to keeping it working.





#### **Getting Started with Aquaponics**

We designed the system to make improvements on the flaws we saw with our first system.

 Most important thing in Aquaponics is pumps and filters.



#### Upgrading the Aquaponics System

We went through 3 different types of upgrades to the filter system resting on a 2 step bio filter.
 A Water heater and sun screen were also added to the system to allow growing through out the year.







#### Facts about Aquaponics Growth at the Michael Unit

- By developing this system we can have higher yields and grow a more diverse crop for the unit.
- Maintaining the system is fairly cheap.
- High startup cost.
- Has to be monitored everyday for the success of the system.
- Much higher learning curve to be able to operate the system.

### Possible Future of Aquaponics for TDCJ

- Able to grow fish within the unit with a fish harvest every 6 to 9 months. – Great for fundraising.
- Most large scale operations are going to convert to this because of the low maintenance cost.
- Organic crops will bring a higher price at market value if we start selling crops.







### Aquaponics Cost:

This system has a higher startup cost but the maintenance cost is much lower. Small scale commercial systems run from \$1500 to \$4000.

#### Non-Donated Parts:

- Water Pump \$150
- Air Pump with hookups \$100
- 6 month supply of fish food \$40
- Net Cups \$30
- Grow medium \$40
- Donated Parts:
  - Grow Tubs PVC piping 3" and bigger
  - If using a raft system IBC totes or pond cloth can be used.
  - Water reservoir- IBC totes work great.

#### Possibility within the Michael Unit

- If we wanted to grow one salad for the inmates a week what would it take? (all amounts are basic on whole sale pricing)
  - 3200 people to feed per day
  - 1600 lbs. of food for each person to have an 8 oz. serving of salad, we need roughly 25600 oz. of greens
  - Average weight of mature lettuce is 12.5 to 18 oz.
  - 25,600 divided by 13 equals 1969.2 heads of lettuce
  - Cost of savings at \$2 per head is \$3938.40 per week.
  - Total saving to the unit would be \$204,796.80.

#### What would it take? One Salad - Lots of Savings?

To grow 2000 heads of lettuce per week we would need a system to support 8000 plants.

There are many options to meet this need and DWC system with aquaponics would be the best way to setup this system for long term use.
 By setting up the system in a modular design we can grow our system to fit our needs.





# **Community Outreach**

- People are hearing about what we are trying to do.
- Various organizations have asked us to speak about our project such as:
  - High School Agriculture classes.
  - Boy Scouts of America
  - East Texas Master Gardener Association
- We can better help them out and therefore help out ourselves in the process so we did....

#### **Class is in Session!**

We started to teach future leaders (Boy Scouts) in our community about hydroponics, aquaponics, and sustainable agriculture.





# **Giving Back**

- With the excess herbs we were able to grow we felt that there was no need to let them go to waste, so we started to donate them various non-profit homeless shelters, orphanages, and food banks.
- We were also able to assist victims of Hurricane Harvey by providing fresh crops to the relief efforts.









#### Statewide Savings



- When designing this system we were not thinking on how this could effect TDCJ.
- We are now keeping logs and making sure anything we do is recorded and can be used in any unit. By designing the system in a modular method, any unit can read our design plans and use these systems.
- If units that do not have a field force use this system they can cut their food cost by 2-10% based on how big their system is designed.
- It is the belief of the Michael Unit field force that every unit should have the ability to grow it own food.

#### Statewide Goals

- Current statewide TDCJ budget for Food Services is \$118,423,150 for 2017 and reducing that by 2% could save the state \$2,368,463 in savings.
- Setting this up within various units would give the opportunity to offenders to learn new skills in a growing job market.
- Providing fresh and healthy food to the offender population would help with the medical issues caused by eating processed foods.

## Hard Facts

- Most crops will grow with hydroponics and aquaponics, but the cost to produce does not equal the saving compared to field production methods. (example – root crops, grains, beans, and peas)
- Hydroponics and Aquaponics will not replace the Field Force, it will just help with the production and savings to the unit.
- Aquaponics will not produce enough fish to feed the entire unit. (A 250 gl. Tank will only produce 90 lbs. of fish every 6 – 9 months.)

#### Take-A-Ways

- Hydroponics and Aquaponics is food production within the walls of a unit. – Less security needed to produce
- Aquaponics is expensive to get started but much cheaper in the long run. Hydroponics is cheaper for a small system but the growth of the system means a growth in the cost of upkeep.
- The Michael Unit Field Force believes enough in the project that they have donated their own time, money, and tools to get it off the ground.

## Special Thanks

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