

HYDROPONICS/AQUAPONICS

**Promoting Today's Agriculture
for Tomorrow's Food Security**



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INTRODUCTION

The Philippines: one of the fastest urbanizing countries in East Asia

- 45% Filipinos now live in urban areas
- Cities generate more than 70% of the country's GDP
- 7 largest cities: NCR, Bacolod, Cebu, Davao, CDO, GenSan, Zamboanga

- Metro Manila
- contributes 36.5% of the country's GDP
- Employment rate: 93.5%

According to WB:

- Urbanization presents economic and productivity opportunities
- Potential driving force for growth and poverty reduction

Source: Philippines Urbanization Review: Fostering Competitive, Sustainable and Inclusive Cities. <http://www.worldbank.org/en/news/press-release/2017/05/29/>

Urbanization or Urban Migration

the natural influx of a segment of population from rural areas to urban centers

- Demand for housing, basic services, jobs, transportation
- Health and sanitation
- Peace and order
- Food supply

- Arable lands in the countryside remain idle and uncultivated
- Land conversion led to decrease in crop production
- Declining share of agriculture to national economy

How to foster  competitive, sustainable and inclusive cities?



Low Agricultural Productivity

Advances of modern agriculture

- Farm mechanization
- Pressurized irrigation
- Protected agriculture
- Plant genetics

Food production

- Remains at the mercy of nature
- Subject to various destructive elements of the changing climate

- **Food shortage**
- **Poverty**
- **Hunger**



Warning from United Nations:

Reduction in global food production by as much as 25% by 2050 due to:

Economic Factors

- Reduced farmers' capacity to buy inputs for food production due to poverty
- Outdated farming practices, low yielding seeds and poor agricultural infrastructure

Environmental Factors

- Climate change
- Natural disasters
- Water shortage
- Land degradation due to increased human activities
- Deforestation, desertification, soil erosion

Social Factors

- Increasing population growth
- Political unrest
- Health problems
- Poverty
- Hunger
- Incoherent government policies

Call to adapt to the changing climate

Climate-smart agriculture

- an approach to guide actions to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate



Promote urban agriculture

- Practice of cultivating, processing, and distributing food in or around a village, town, or city



Hydroponics and aquaponics

- Forms of soilless agriculture without using soil as a medium of growth and reservoir of water and fertilizer



What is hydroponics/aquaponics?

Hydroponics

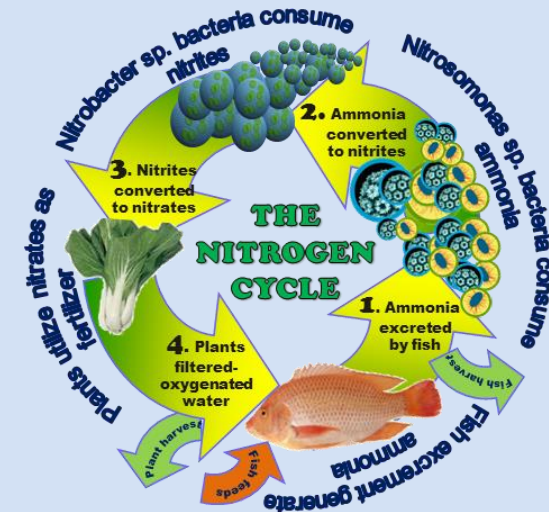
- Came from Greek words “hudur” and “ponos”
- “water-working”
- Proves that soil is not crucial for plants to grow
- Plants absorb essential mineral nutrients as inorganic ions in water
- Nutrients are artificially introduced into plant's water supply

Aquaponics

- Portmanteau of two cultures
 - ✓ Aquaculture – raising fish
 - ✓ Hydroponics – crop production
- Raising of fish and vegetables in one infrastructure
- Fish gives off ammonia, bacteria converts ammonia to fertilizer
- Plants clean the water

Improved productivity

- More, safer, cleaner vegetables
- Savings in water, energy fertilizer, space



▪ almost any terrestrial plant can be grown hydroponically

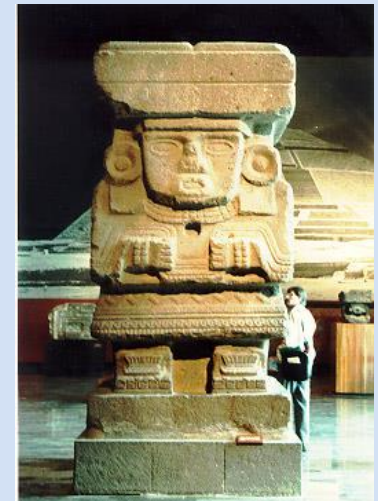
History of hydroponics/aquaponics?

The Aztec Indians

- Nomadic tribe of the Americas in 150-1130 CE
- Neighboring tribes treated them roughly
- Drove them onto marshy shore of Lake Tenochtitlan (Mexico City) and denied of arable land
- Built floating gardens called *chinampas*
- Rafts of branches and reeds; piled soil dredged from the lake; abundantly grew vegetables, fruits and flowers
- Designed in a gamble to stave off poverty

Built a strong kingdom

- Lesson of survival
- First model of soilless culture
- First viable design of sustainable agriculture



Basic Concepts

Geoponics when planting in the soil; traditional agriculture



Hydroponics when clean water and nutrients are used

Aquaponics when aquaculture is integrated with hydroponics

Organics when clean organic extracts are used



Concepts of hydroponics/aquaponics technologies

Nutrient solution is the heart of hydroponics

- Maintaining the quality determines the success or failure of any investment

Nutrient solution

Macro Elements
(N, P, K, S, Mg, Ca)

Micro Elements
(Fe, Zn, Mn, Cu, Cl, Mo, Bo)

Parameters

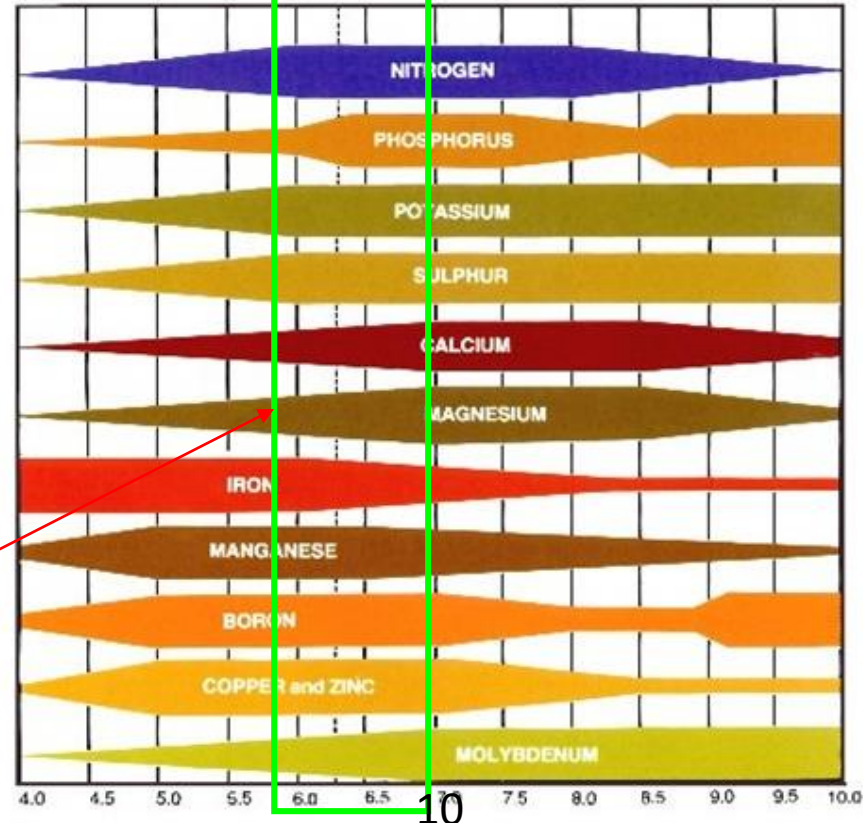
- pH: 5.8 – 6.8
- Temp: 20-24°C
- EC: 1-3 mS/cm
- DO: 4-10 ppm



O
H
C

**Optimum
pH range**

pH related Nutrient Availability
Acidic ← | → Alkaline



The Central Luzon State University, Nueva Ecija

in fulfilling its mandate and status as a premier agricultural university in the Philippines and Southeast Asia

- Established a demonstration farm and experiment station for hydroponics and aquaponics
- With models and systems for different types of vegetables

Promote and share technologies



CLSU Hydroponics and Aquaponics Technologies (CHAT)

TRAINING WORKSHOP

Structures

- Tropical greenhouse
- Growing systems
- Vertical gardens
- Backyard models
- Household model

Other technologies

- Nutrient solution formulation
- Integrated pest management
- Techno-guides for the production of various vegetables

Proofs of concept that these technologies can be done using locally available materials and Filipino ingenuity



Production systems



Production systems

Commercial model



Seminar/workshop



DA-BAR Head Office, Quezon City, 2017



Batac City, Ilocos Norte, 2017



DepEd, San Carlos City, Pangasinan, 2018




CLSU, 2017

Seminars/educational videos available on-line

Secure | <https://www.youtube.com/watch?v=sSXl1d1dQUg>

YouTube PH Search



Dr. Chito F. Sace
Professor, Central Luzon State University

2:51 / 4:22

Aquaponics Multi-Crop Systems ReGenerate Global Coasts

This video shows Dr. Chito F. Sace, a professor at Central Luzon State University, in a laboratory setting. He is wearing a light green polo shirt and glasses. He is standing next to a man in a red polo shirt and another man in a dark blue sweater. They are looking at a piece of equipment, possibly related to aquaponics. The video player shows a progress bar at 2:51 / 4:22.

Secure | <https://www.youtube.com/watch?v=BwKz-woZECg&t=5085s>

YouTube PH Search



DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL RESEARCH

CONCEPT OF SOILLESS CULTURE

FREE SEMINAR

LIVE @ BAR

Production Technology using Hydroponics and Aquaponics
Central Luzon State University

27:50 / 2:53:58

Production Technology using Hydroponics and Aquaponics

This video is a recording of a free seminar titled "CONCEPT OF SOILLESS CULTURE" presented by the Department of Agriculture, Bureau of Agricultural Research. The seminar is held at a "LIVE @ BAR" location. The video shows a man in a white shirt presenting to an audience. The video player shows a progress bar at 27:50 / 2:53:58.

Inbox (1) - chitoface@... Chito F Sace (10 unread) - cfsace227... (18) Hydroponics and A... ICCEM-CLSU, Au

Secure | <https://www.youtube.com/watch?v=Wgn15MGn19E>

YouTube PH Search



We want to revolutionize agriculture in our country.


8:42 / 25:51

Hydroponics and Aquaponics video presented by Dr. Chito F. Sace

This video shows Dr. Chito F. Sace, a professor at Central Luzon State University, speaking. He is wearing a light blue polo shirt with a logo on the chest and glasses. He is sitting in front of a white cabinet with several binders on it. The video player shows a progress bar at 8:42 / 25:51.

Secure | <https://www.youtube.com/watch?v=0t5ZT2v98TE>

YouTube PH Search



Food consumption vs production

- Close relationship of vegetable consumption to food production
- Low vegetable production
- Climate change, water scarcity, over-population, loss of arable land
- Food production is a moving target

5:17 / 30:19

Hydroponics & Aquaponics By Dr. Chito F. Sace Part 1

This video shows a presentation on "Food consumption vs production". The presenter is a man in a dark sweater and glasses, standing next to a large screen. The screen displays a list of bullet points: "Close relationship of vegetable consumption to food production", "Low vegetable production", "Climate change, water scarcity, over-population, loss of arable land", and "Food production is a moving target". The screen also shows images of various vegetables and fruits. The video player shows a progress bar at 5:17 / 30:19.

CHAT as agri-tourism destination



CHAT as venue for research



Conclusion

- We can no longer live just like our forefathers did (by hunting animals and gathering fruits in the forest)
- Deliberately we have to produce our food: more, cleaner and safer food
- Not only in the countryside but in the city
- Hone today tomorrow's agriculture
- Hydroponics/aquaponics: the future agriculture

FUTURE COMMUNITIES



Acknowledgement

- DOST-PCAARRD
- DA-Bureau of Agricultural Research
- The Fulbright-Philippine Agriculture Scholarship Program
- Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University
- National Academy of Science and Technology - Philippines



CHAT Demo Farm and Experiment Station is an R&D assistance of Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development of the Department of Science and Technology (PCAARRD-DOST) dedicated to the next generation.

Established in 8,700 sq. m. area, the station aims to advance innovations in soilless agriculture, empower agripreneurs toward food sustainability and security, and showcase conservation of earth's limited resources like energy, water and space.

CLSU is willing to share its expertise and technologies.

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