Universität Rostock

Traditio et Innovatio

Europäischer Fischereifonds

Projekt:

Aquaponic research at University Rostock (Fac. Agricultural and Environmental Sciences)

Harry W. Palm

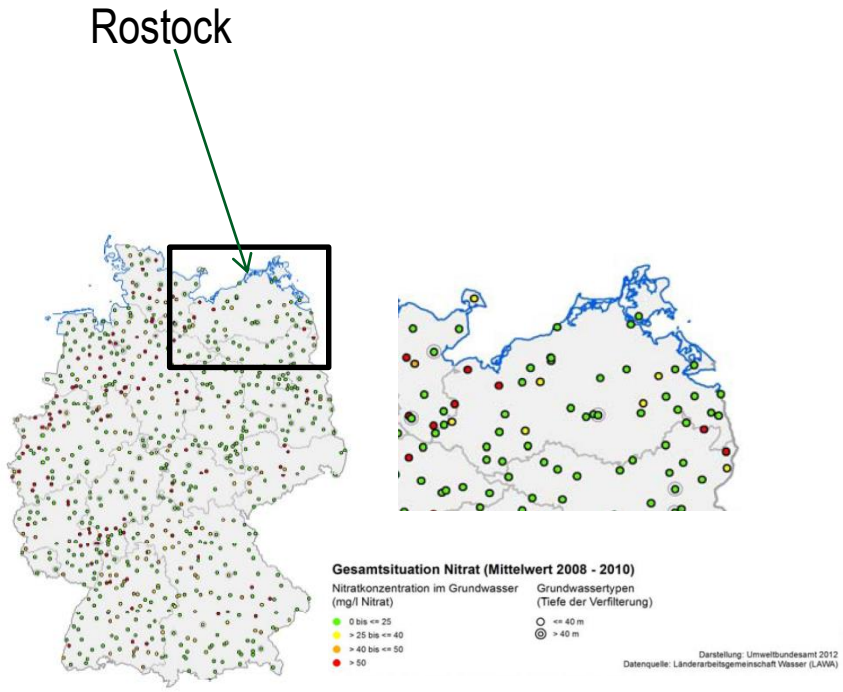
U.Knaus & S. Strauch

Background

- Lowest populated state in Germany
- Dominated by farmers, less industry
- Tourist destination No. 1
- 540 biogas plants (warm water available)
- Commercial African catfish production since 7 years, appr. 1000 to mainly by farmers
- State policy to increase aquaculture production

- BUT: No access to surface water
- Prevention of effluent water

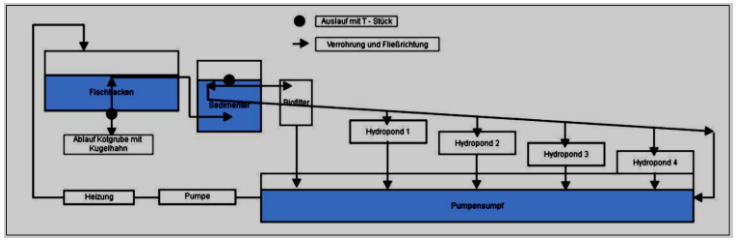
→ Knowledge based combination of commercial aquaculture and plant cultivation (aquaponics)



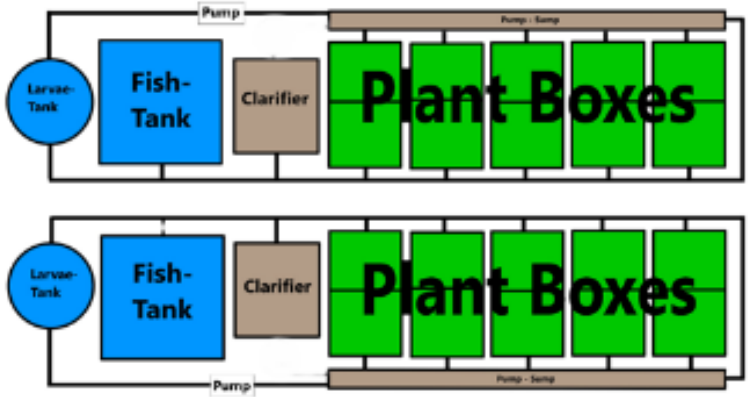
Nitrate in ground water and into the Baltic Sea

The problem

- Aquaponic literature scarce
- Mainly from small scale experimental systems
- Data not comparable
- Not originating from „commercial farms“
- Access to commercial farms very limited
- Literature not public domain



- General statement „Aquaponics in Germany economical NOT sustainable“ (HOW DO THEY KNOW ?)



- How to give recommendations concernring aquaponics to investors/farmers ?

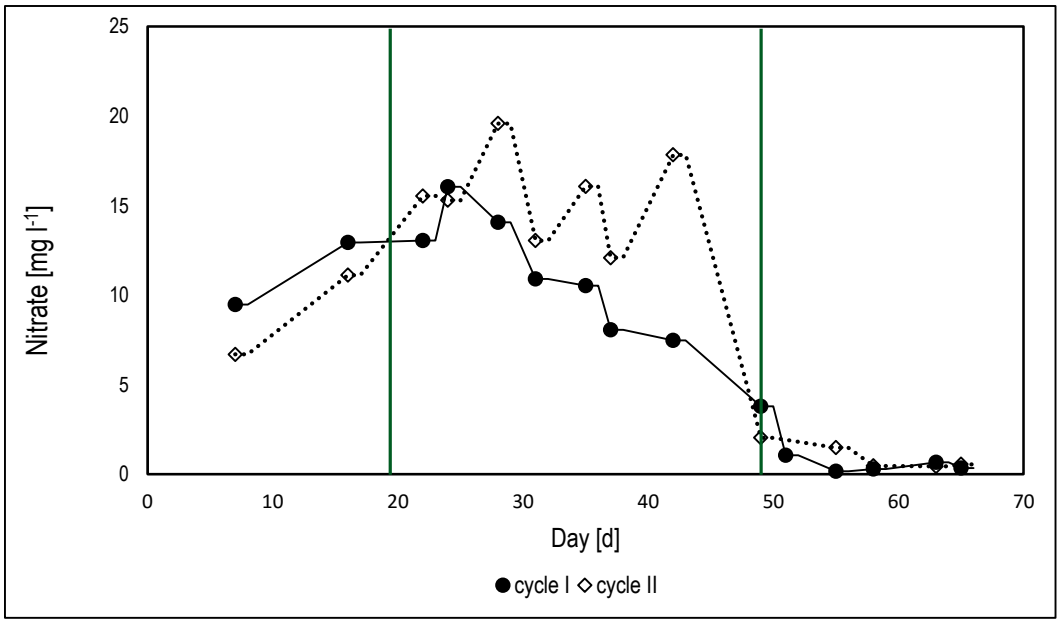
Cucumber after 70 days

O. niloticus – C. carpio

Spring - Summer

Cucumber, Tomato, Salat

nitrate [mg l^{-1}]



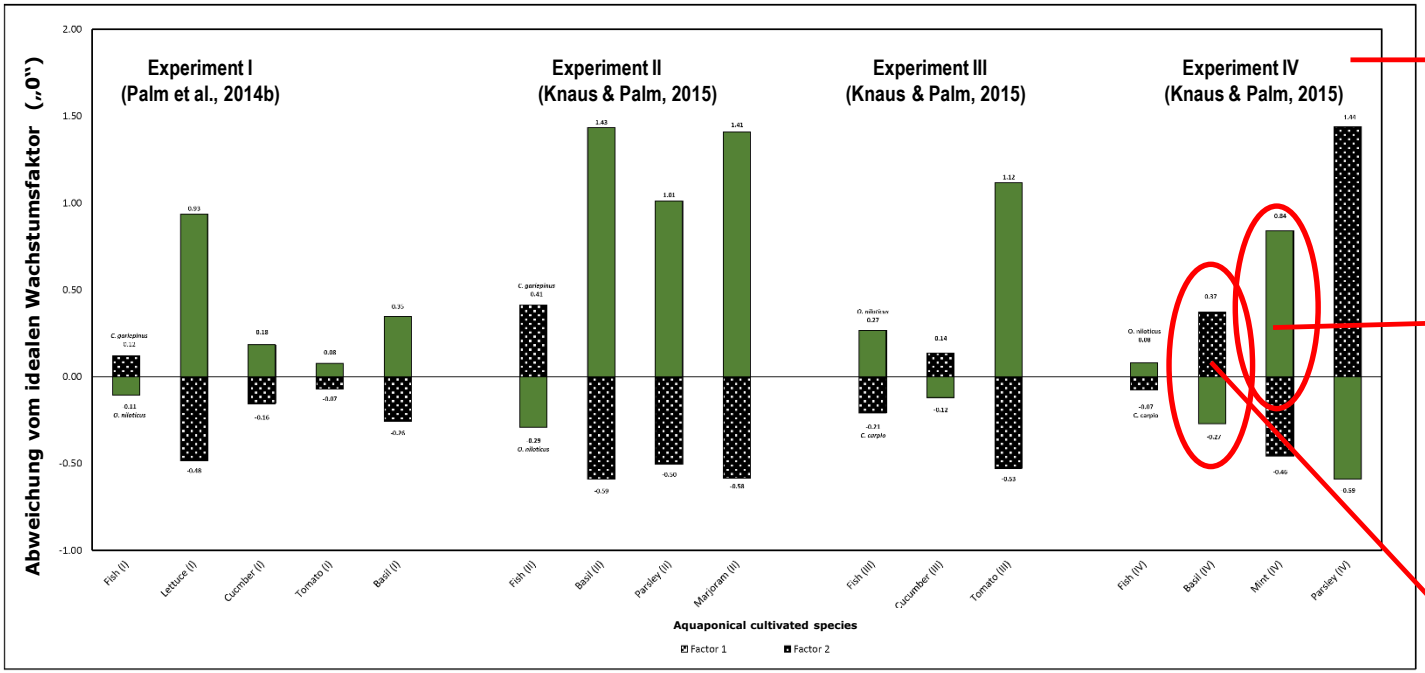
Effects:

- Consumption of nitrate in both cycles
- Cleaning the process water in both species

Knaus, U. & Palm, H.W. (submitted): Effects of the fish biology on aquaponical cultured vegetables under optimal conditions.

The Aquaponic factor (AF)

- Fish species decides onto plant growth under identical cultivation conditions
- **Plant growth performed best with *O. niloticus***
- Plant growth in Kombination with *Cyprinus carpio* was less than combined with *O. niloticus*
- Growth of *C. gariepinus* was better than carp and tilapia



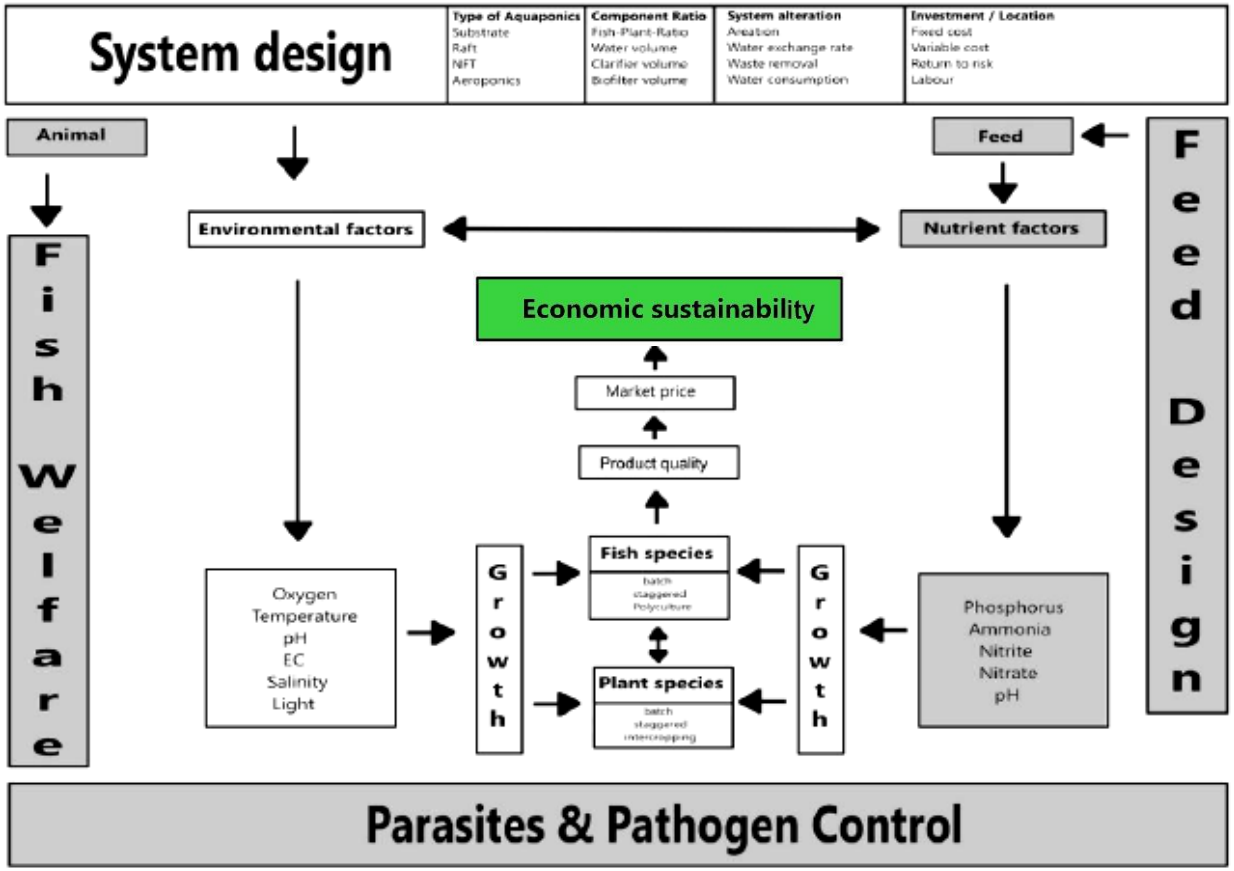
experiments independent

Mint 2 x Better growth with Tilapia compared with carp

Basil better, not significant growth with carp compared with Tilapia

Berechnung: AF_{Fisch} = (Biomasse Fisch 1 / Biomasse Fisch 2)-1 und vice versa
bzw. $AF_{Pflanze}$ = (Biomasse Pflanze 1 / Biomasse Pflanze 2)-1 und vice versa

Pilot project: Commercial aquaponics possible in MV ?



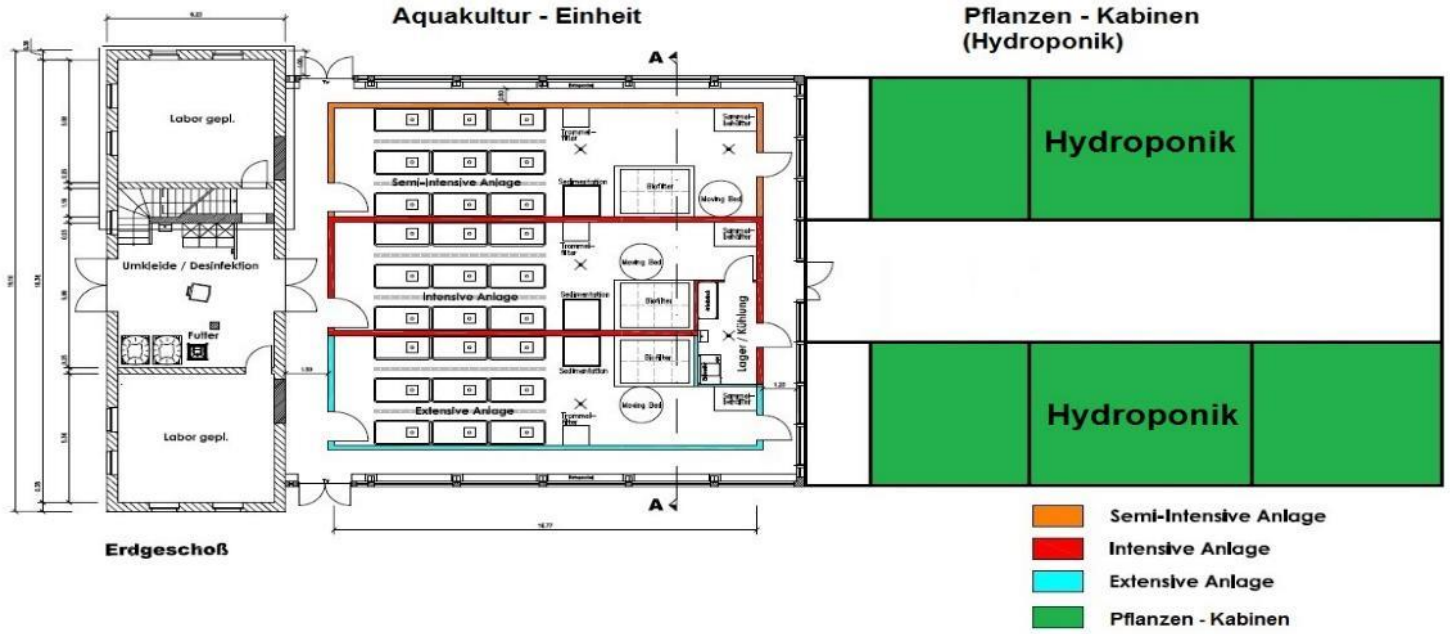
Palm et al. (2014a)

Frequently asked questions

- Can we combine commercial African catfish production with commercial plant cultivation ?
- Which plant species can be used ?
- Investment costs ?
- Labor costs reasonable ?
- Technical adjustments neccessary ?
- Nutrient flows ?
- Education level of labor force ?
- Product quality ? Does a cucumber smells fishy ??

- Scientific support in the case of an investment ?

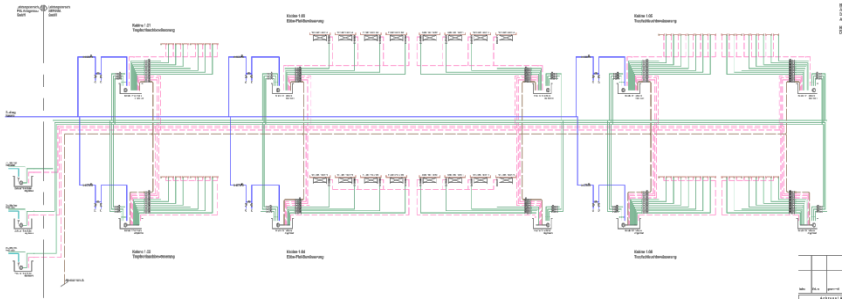
The FishGlassHouse (Aquaculture & Hydroponics)



- → 3 aquaculture units
- → 6 hydroponic units
- → construction as coupled & decoupled systems

The FishGlassHouse

Fish stocked (50, 100, 200 kg staggered) in Juli 2015, opened in 27.11.2015



3 Aquaculture units

automatic control

- **extensive unit**
- **semi-intensive unit**
- **intensive unit**

(*Clarias gariepinus*)

- **9 fish Tanks per unit**

automatic feeder

The challenge

- Can we run a commercial system beside our regular jobs ?? (work load)
- Product quality
- **Student education in commercial RAS and its combination with aquaponics (MSc. Aquaculture)**

Nutrient water transfer tanks (exchange of water, connection to drainage)

aquaculture units (3) ⟷ hydroponic cabins (6)

The hydroponic unit - automatic control of environmental parameters

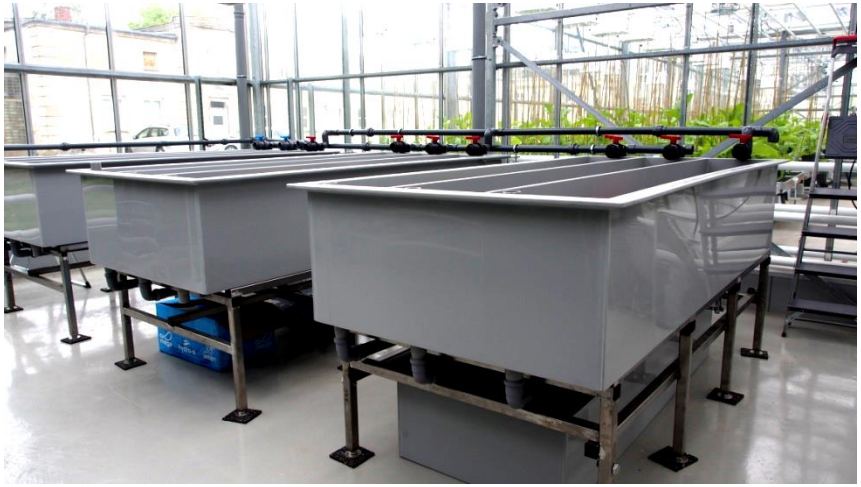
- light intensity [lux]
  → automatic shading
- temperature min-max
  → automatic ventilation
- WLAN, Internet

The FishGlassHouse

- Test of different hydroponik subsystems (NFT / Ebb - Flood / Floating raft) first on cucumber, now on other plants => INTENSIVE Process water

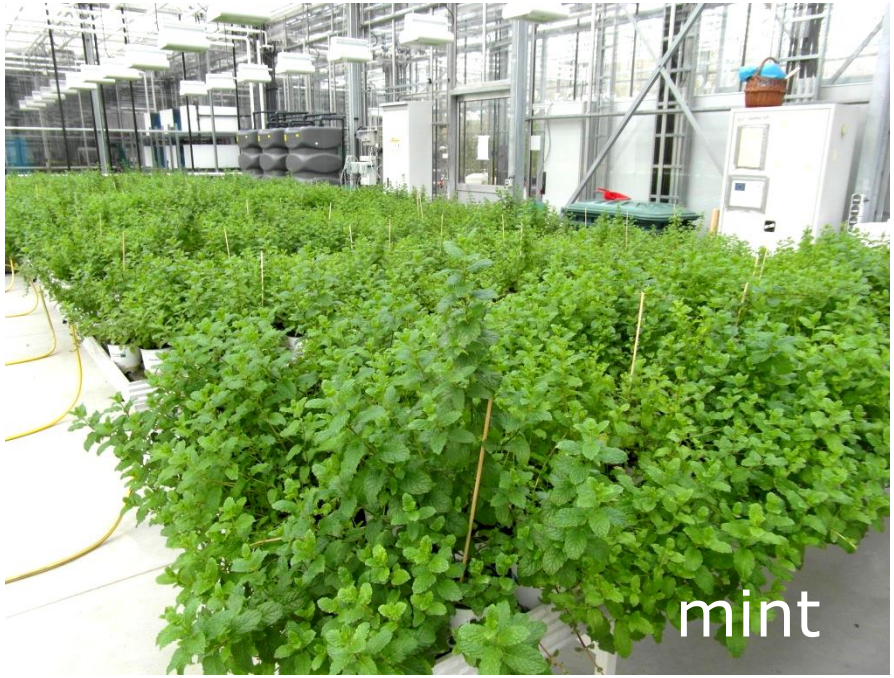
Aquaponic facility III from spring 2015 - present

Polyponics



- Polyculture with *C. gariepinus* and *O. niloticus*
- Test of growth effects on different herbs
- Stand-alone recirculation system

The FishGlassHouse



- Commercial aquaponic production in standard ebb-flood system (mint)
- Comparison of EXTENSIVE and INTENSIVE cultivation with control
- Cooperation with the largest plant producer in Rostock (quality and market access)

Upscaling

Palm, H.W., Strauch, S. & Knaus, U. in Vorb.

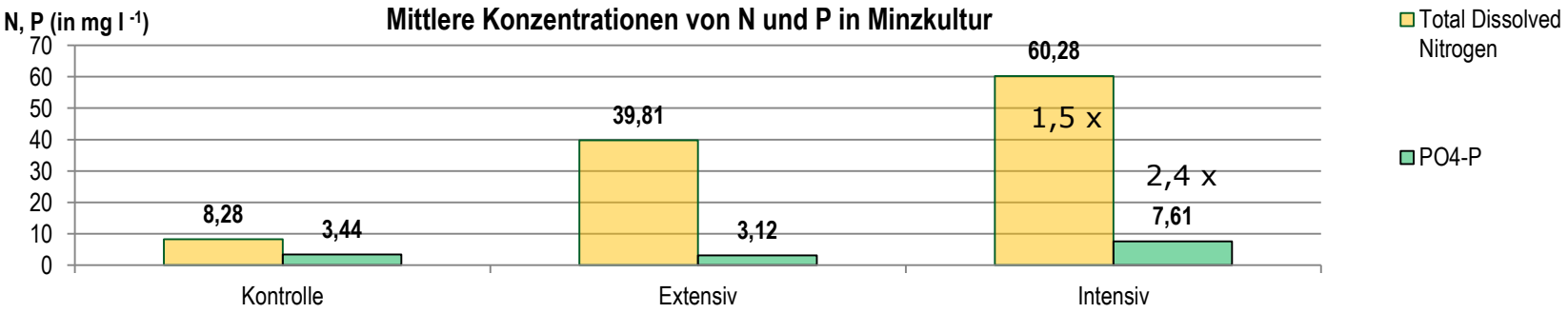
control (basic fertiliser)

extensive

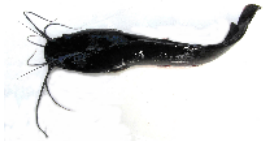
35 FB^{-1}

intensive

140 FB^{-1}

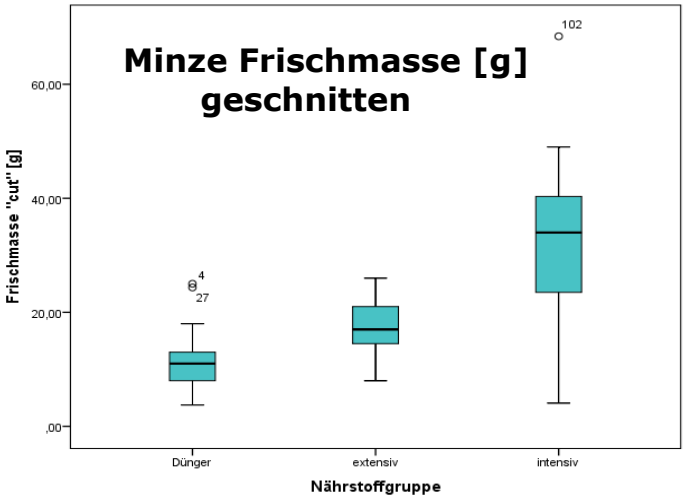


FishGlassHouse



Parameter	Kontrolle (Dünger)	Extensiv	Intensiv	Faktor
Sprossanzahl [Stk.]	1,61^{a}±0,66	1,56^{a}±0,62	**2,25^{b}±1,16**	1,44
Blatt-Fläche [cm²]	5,74^{a}±2,20	5,63^{a}±2,14	**10,91^{b}±2,46**	1,93
Blatt-Länge [mm]	5,45^{a}±1,42	5,42^{a}±1,39	**8,61^{b}±1,64**	1,58
Frischmasse ungeschnitten [g]	120,56^{a}±51,77	165,46^{b}±71,67	**190,66^{b}±105,57**	1,15
Frischmasse geschnitten [g]	11,16^{a}±5,26	17,38^{b}±4,66	**31,83^{c}±13,83**	1,83

Ø : 1,586



Lessons learned

- Mint cultivation best with INTENSIVE water ($p<0,05$)
- Commercial production of African catfish with Mint possible
- Reduction of **20% water in fish production and 100 % in Mint production**

Compared with regular production

Hedara helix (2 sorts)

Thanks for your attention