

EVALUATION OF A NEW
ZEALAND BASED AQUAPONIC
SYSTEM USING ASIAN GRASS
CARP *Ctenopharyngodon idella*

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AQUAPONIC SOLUTIONS

WHAT IS AQUAPONICS?

- Aquaponics is the integrated, aquatic farming of both fish and plants in the same system.
- Fish are kept in tanks and produce waste.
- The plants are kept in a hydroponic component and use the fish waste as a nutrient for growth.
- Water is therefore shared between the two components.



EXPERIMENTAL SET UP

- Fish culture system based on standard RAS approach.
- Fish system contained in an insulated, environmentally controlled room.
- NFT (Nutrient Film Technique) hydroponic component.
- Hydroponics contained in a greenhouse (225 m²)



FISH ROOM/SYSTEM



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FISH ROOM/SYSTEM



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HYDROPONICS/GREENHOUSE



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EXPERIMENTAL DESIGN

- One fish system used (for aquaponic side).
- Standard, automated hydroponic nutrient supply (for hydroponic side).
- Side by side comparative plant growth approach.
- 50% standard hydroponics; 50% aquaponics.
- Fish measured for growth and FCR.
- Plants measured for plant weight (leafy).



GREENHOUSE LAYOUT



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RESULTS - FISH

Description	Result
Total system fish biomass harvested (kg)	108.5
Total biomass still in system (kg) – Feb 2011	12.0
Total starting fish biomass (kg) – Nov 2009	27.9
Total live fish production (kg)	92.6
Total fish number at start – Nov 2009	335
Total fish number harvested	174
Total fish deaths	106
Total fish remaining – Feb 2011	55
Total feed fed (kg) – to Feb 2011	168.5
Food conversion ratio (FCR)	1.4



RESULTS - FISH

- Fish growth was good for an omnivore on low feed protein (92.6kg).
- Fish death high (31.6%); mostly caused by fish escaping tanks.
- FCR was good for an omnivore on low protein feed (1.4).
- Are Grass Carp suited to tank culture?



RESULTS - FISH



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RESULTS - HERBS

Crop	Weight (g) hydroponic	Weight (g) Aquaponic	Sig Diff?	Better System	Difference (%)
Dill-Feb	10.9	10.5	No	Same	0
Rocket-Feb	42.4	47.1	No	Same	0
Dill-March	12.2	16.0	No	Same	0
Rocket-	49.0	51.9	No	Same	0
Corian-Mar	16.5	60.5	Yes	Aquaponic	267
Dill-April	13.5	20.3	Yes	Aquaponic	50
Parsley-April	17.2	21.5	Yes	Aquaponic	25
Corian-April	11.0	28.7	Yes	Aquaponic	160
Dill-April (2)	11.1	12.1	No	Same	0
Pit-April(2)	14.6	24.9	Yes	Aquaponic	71
Dill-April(3)	17.1	14.8	No	Same	0
Rocket-May	44.2	29.8	Yes	Hydroponic	48
Corian-May	5.3	8.0	Yes	Aquaponic	51
Dill-May	11.7	14.5	No	Same	0
Rock-May(2)	56.4	62.5	Yes	Hydroponic	94
Parsley-May	19.4	32.0	Yes	Aquaponic	65
Parsley-May (2)	34.1	58.6	Yes	Aquaponic	56
Corin-May (2)	9.4	10.5	No	Same	0
Corian-May (3)	18.5	13.9	No	Same	0



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RESULTS - HERBS

- 17 out of 19 herb crops exhibited equal, or better, growth than standard hydroponics.
- The 2 crops that exhibited better hydroponic growth were both Rocket crops.
- 8 of the remaining 17 crops exhibited better growth aquaponically.
- Some large differences in growth were observed.



RESULTS – HERBS (QUALITY)

Crop	% Sales Hydroponic	% Sales Aquaponic
Dill-April(3) 2010	17	27
Rocket-May 2010	32	45
Coriander-May 2010	71	72
Rocket-May(2) 2010	33	43
Pit-May 2010	38	60
Pit-May (2) 2010	29	26
Coriander-May (2) 2010	66	79
Coriander-May (3) 2010	30	47
Coriander-May (4) 2010	16	54
Coriander-June 2010	52	58



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HERBS



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HERBS



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RESULTS - LETTUCE

Variety	Top Weight (g) Hydroponic	Top Weight (g) Aquaponic	Sig Diff?	Better System	Difference (%)
Gaugin	130.83	168.00	Yes	Aquaponic	28
Princess	117.00	246.63	Yes	Aquaponic	111
Explore	211.86	293.78	Yes	Aquaponic	39
Ashbrook	220.25	266.38	Yes	Aquaponic	21
Satre	173.11	223.56	Yes	Aquaponic	29
Robinio	177.88	204.43	No		
Obregon	142.50	223.40	Yes	Aquaponic	57

Summer

Variety	Top Weight (g) Hydroponic	Top Weight (g) Aquaponic	Sig Diff?	Better System	Difference (%)
Gaugin	271.61	327.44	Yes	Aquaponic	21
Princess	177.38	204.94	No	Neither	
Explore	709.47	625.93	No	Neither	
Ashbrook	497.67	453.17	No	Neither	
Satre	322.20	349.20	No	Neither	
Robinio	293.22	345.78	Yes	Aquaponic	18
Obregon	354.87	341.53	No	Neither	

Winter



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RESULTS – LETTUCE (COMMERCIAL RUN)

Date Harvested	Culture Time (days)	Gross Weight (kg)	Lettuce number
10/05/2011	63	48.5	180
17/05/2011	61	48.5	180
24/05/2011	61	55.6	235
31/05/2011	61	63.5	280
7/06/2011	61	46	266
14/06/2011	61	79.6	379
21/06/2011	61	36	191
28/06/2011	68	46	199
5/07/2011	68	46.8	191
11/07/2011	74	39	192
19/07/2011	75	39	192
26/07/2011	82	46.5	198
2/08/2011	82	44.4	192
9/08/2011	89	44	192
16/08/2011	89	45.5	192
23/08/2011	96	47	198
23/08/2011	89	46	192
30/08/2011	96	46	191
30/08/2011	89	46	192
6/09/2011	89	47	197
13/09/2011	89	45.9	192
20/09/2011	89	85.6	192
20/09/2011	82	85.6	192
20/09/2011	75	85.6	176
Total		1,263.6	4,981



RESULTS - LETTUCE

- Summer comparisons – aquaponic better in 6 out of 7 varieties; other 1 statistically identical.
- Winter comparisons – aquaponic better in 2 out of 7 varieties; other 5 statistically identical.
- Commercial run – 1,264kg and 4,981 heads produced in 4 months, from 58m² of growing area.



LETTUCES



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LETTUCES



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SALAD MIX



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SPINACH



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FUTURE

- I am developing an approach to integrate a hydroponic growing component that can attach to and treat the waste water stream produced by commercial scale RAS (with Lachie McKenzie, NMIT)
- Does NOT treat entire water volume (traditional Aquaponics), but treats the waste water stream (10 – 15 % of the system water volume/day).



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