AQUAPONICS
Media Systems & My Calculator

Dr Wilson Lennard
INTRODUCTION

- There is too much rubbish spoken in the backyard community and forums
- Old wives tales and untested approaches don’t assist anyone
- No backyard system sellers actually use any technical model(s) to design systems
- It is a “suck it and see” industry
REASONS FOR MY MODEL

- I got sick of the haphazard approach of backyard system sellers
- I get sick of getting emails from countless backyard operators with problems
- I was asked to produce a biofilter model when in Hawaii with Dr. Rakocy last year, so decided to write a full media bed model
AQUAPONIC SYSTEM DESIGN

All aquaponic systems (commercial, backyard) should be designed the same way:

- Decide on plant growing area
- Calculate the fish feed required to supply that plant growth area
- Calculate the average fish biomass required to utilise that fish feed
- Calculate fish tank volume based on biomass to be held
TYPICAL BACKYARD SYSTEM
## THE MODEL

### Aquaponic Media Bed Sizing Model

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Input Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish tank Volume (L)</td>
<td>2,000 The fish tank volume you choose for your system</td>
</tr>
<tr>
<td>Fish culture density (kg/m³) (between 5 and 30)</td>
<td>10 The maximum density of fish you wish to keep in your fish tank (generally up to 30 kg/m³)</td>
</tr>
<tr>
<td>Daily feed rate (% of total system fish weight)</td>
<td>1 Daily fish feeding rate (a percentage of the total fish biomass) (usually between 1 &amp; 2%)</td>
</tr>
<tr>
<td>Feed protein (%)</td>
<td>43 The protein content of the fish feed (usually 43-50% for carnivores, 33% for omnivores)</td>
</tr>
<tr>
<td>Surface area of media (m²/m³)</td>
<td>300 Specific surface area of the biofilter media used (Gravel = 300, Lecca = 250, Volcanic = 400)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Output Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biofilter volume required (L)</td>
<td>67 The size of the biofilter required - for majority deep flow systems</td>
</tr>
<tr>
<td>Flow rate required (L/hour)</td>
<td>410 The water volume required to be pumped to your grow bed every hour</td>
</tr>
<tr>
<td>Surface area of bed required for mineralisation (m²)</td>
<td>3.8 The bed surface area required to mineralise the solid fish waste (300 mm depth)</td>
</tr>
<tr>
<td>Suggested fish tank volume (L)</td>
<td>2,338 The suggested fish tank volume based on compensation for the flood cycle volume loss</td>
</tr>
<tr>
<td>Bed surface area (leafy greens) (m²)</td>
<td>5.5 The bed area required for leafy green plants based on the UVI tanks (60 g/m²/day)</td>
</tr>
<tr>
<td>Bed surface area (fruiting) (m²)</td>
<td>2.7 The bed area required for fruiting plants based on the UVI tanks (300 g/m²/day)</td>
</tr>
</tbody>
</table>
THE MODEL

- The model works by entering the desired fish tank size first, which is counter to how systems should be designed.
- This was done because this is what everyone expects.
- A 10 page “How to use…” document is provided with the model.
THE MODEL
The input parameters include:

- Desired fish tank volume
- Desired average fish culture density
- Average daily feed rate (as a % of fish biomass)
- Fish feed protein content (32% - Tilapia)
- Media specific surface area (300 m²/m³)
The outputs include:

- Biofilter volume required
- Flow rate required
- Bed surface area required to meet solids mineralisation
- Updated fish tank volume (compensate for media bed flood volume)
- Bed surface area required for leafy green plants
- Bed surface area required for fruiting plants
USING THE MODEL

- Once the fish tank volume, fish density, feed rate, feed protein content and SSA of media is added, the model outputs several parameters key to your media bed area size.
- Biofiltration is always met for media bed.
- Important outputs are the bed areas; always use the largest bed area outputs.
- The model can be used in reverse by using a “lets see how this goes” approach.
ACCESS TO THE MODEL

- The model and associated “How to use…” document may be downloaded for free from my web site: www.aquaponic.com.au
- There is also a long page of information for media bed and backyard system design
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