Reducing Water Wastage by Growing and Finishing Pigs at Nipple Drinkers

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Background

- Water disappearance
  - 1.9 ~ 6.8 L/pig/d
  - = intake + wastage
  - Up to 60% of water wasted at nipple drinkers (Brooks, 1994)
- Water wastage related to large amounts of slurry produced on pig units
Background

- Causes of water wastage
  - Drinker type (nipple vs. bowl)
  - Drinker height
  - High flow rate (low drinking speed)
  - Group size
  - Pig size
  - Others (temperature, tail bites...)

Objectives

- To reduce water wastage while maintaining adequate water intake of pigs at nipple drinkers
  - Water intake, wastage and maximum intake rate (study 1)
  - Effects of nipple height and flow rate on water wastage (study 2)
  - To reduce water wastage by drinker management (study 3)
Experiment 1

- Animals
  - Six pens of 8 female pigs
  - Body weight, kg
    - Period 1 = 53 ± 4.9
    - Period 2 = 72 ± 5.5
  - One-space dry feeder (pelleted feed *ad libitum*).
  - One nipple drinker

- Housing
  - Partially slatted floor
  - Space allowance = 1.4 m² / pig
  - Room temperature = 20 ~ 23 °C

Facilities

- Test pens
  - 2 raised pens (1.4 m² / pig)
  - 60 cm above the floor
  - A nipple drinker connected with a water meter
  - Collecting basket below the drinker under the pen floor

- Thermal Environment
  - Temperature = 22 ± 1.2 °C
  - RH = 63 ± 7.7%
Drinker height and flow rate

- **Height**
  - 50 mm above the shoulder height of the smallest pig (Bill and Barber, 1990)
  - Shoulder height (Patheric, 1983)
    - \( \text{SH (mm)} = 150 \times \text{BW (kg)}^{0.33} \)

- **Flow rate** (Carr, 1994)
  - 650 ± 14 mL / min (Period 1)
  - 1000 ± 65 mL / min (Period 2)

Data collection

- **Water disappearance**
  - On daily pen basis for 4 days
- **Water wastage**
  - On daily pen basis for 4 days
- **Water intake**
  - \( \text{Water intake} = \text{(Disappearance - Wastage)} \)
- **Feed intake**
  - Weighed in and weighed back on a pen basis
Data collection

- Maximum water intake rate
  - Determined after 4 h water deprivation
  - Accessed at two flow rates
    - 650 vs. 1300 mL/min (period 1)
    - 1000 vs. 2000 mL/min (period 2)
  - Allowed to access water by 20 sec individually
- Water intake rate (mL/min)
  \[ \text{Water intake rate (mL/min)} = \frac{\text{disappearance} - \text{spillage}}{\text{drink time}} \]

Results

<table>
<thead>
<tr>
<th>Item</th>
<th>Period 1</th>
<th>Period 2</th>
<th>SE</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW, kg</td>
<td>53 ± 4.9</td>
<td>72 ± 5.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Disappearance, L</td>
<td>5.3</td>
<td>7.3</td>
<td>0.25</td>
<td>0.01</td>
</tr>
<tr>
<td>Wastage, L</td>
<td>1.3</td>
<td>1.9</td>
<td>0.11</td>
<td>0.01</td>
</tr>
<tr>
<td>Intake, L</td>
<td>4.0</td>
<td>5.4</td>
<td>0.19</td>
<td>0.01</td>
</tr>
<tr>
<td>Water : feed</td>
<td>2.4</td>
<td>2.1</td>
<td>0.12</td>
<td>0.18</td>
</tr>
<tr>
<td>Intake/BW, mL/kg</td>
<td>78</td>
<td>75</td>
<td>3.8</td>
<td>0.59</td>
</tr>
<tr>
<td>Wastage, %</td>
<td>25</td>
<td>26</td>
<td>1.9</td>
<td>0.66</td>
</tr>
</tbody>
</table>
Relation between water intake rate and drinker flow rate

Relation between water wastage and drinker flow rate
Experiment 2

- Animals
  - Four pens of 8 female pigs
  - Body weight
    - Grower period = 23 ± 2.7 kg
    - Finisher period = 68 ± 5.3 kg
- Housing as in Experiment 1
- Facilities as in Experiment 1

Drinker height and flow rate

- Height
  - Constant: 330 mm
  - Recommended (50 mm above shoulder height)
- Flow rate
  - 500 mL/min
  - 1000 mL/min
Data collection

- Water disappearance
- Water wastage
- Water intake
- Feed intake

Effect of drinker flow rate on water disappearance

![Chart showing water disappearance for Grower and Finisher at 1000mL/min and 500mL/min.]
Effect of drinker flow rate on water wastage

The flow rates did not affect either water or feed intake.
Effect of drinker height on water disappearance

Effect of drinker height on water wastage
The drinker heights did not affect either water or feed intake.

Experiment 3

- **Animals**
  - Sixteen pens of 18 pigs
  - 9 females and 9 males per pen
  - Body weight at start: $32 \pm 4.5$ kg
  - Dry mash diet *ad libitum*

- **Housing**
  - Fully slatted floor
  - Space allowance: $0.78 \text{ m}^2 / \text{ pig}$
  - Room temperature: $18 \sim 25 \degree \text{C}$
Drinker management

- Nipple drinkers
  - Constant low height (L-N)
    - 480 mm
  - 50 mm above the shoulder (S-N)
    - adjusted every 2 wk
  - Constant high height (Step)
    - 730 mm = 480 + 250 (Step)
- Bowl drinkers at 480 mm (B)

Flow rate = 1000 ± 42 mL/min

Data collection

- Performance
  - ADG (every 2 wk)
  - CV of weight
- Water disappearance
  - Daily pen basis
  - One water meter per pen
- Manure output
  - Weekly pen basis
  - Manure level in each individual pit
### Effect of drinker management on body weight

<table>
<thead>
<tr>
<th>Item</th>
<th>Bowl</th>
<th>L-N</th>
<th>S-N</th>
<th>Step</th>
<th>SE</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Pen</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Initial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW, kg</td>
<td>31.5</td>
<td>31.8</td>
<td>31.7</td>
<td>32.1</td>
<td>0.67</td>
<td>0.92</td>
</tr>
<tr>
<td>CV, %</td>
<td>13.3</td>
<td>16.3</td>
<td>14.5</td>
<td>12.8</td>
<td>1.21</td>
<td>0.23</td>
</tr>
<tr>
<td>Final</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW, kg</td>
<td>104.2</td>
<td>106.0</td>
<td>102.9</td>
<td>104.0</td>
<td>1.98</td>
<td>0.74</td>
</tr>
<tr>
<td>CV, %</td>
<td>10.8</td>
<td>10.6</td>
<td>10.5</td>
<td>10.8</td>
<td>1.18</td>
<td>0.99</td>
</tr>
</tbody>
</table>

### Effect of drinker management on ADG (g/d)

<table>
<thead>
<tr>
<th>Item</th>
<th>Bowl</th>
<th>L-N</th>
<th>S-N</th>
<th>Step</th>
<th>SE</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>wk 0-4</td>
<td>732</td>
<td>693</td>
<td>721</td>
<td>735</td>
<td>32.0</td>
<td>0.78</td>
</tr>
<tr>
<td>wk 4-8</td>
<td>990</td>
<td>1010</td>
<td>974</td>
<td>902</td>
<td>60.1</td>
<td>0.61</td>
</tr>
<tr>
<td>wk 8-12</td>
<td>876</td>
<td>950</td>
<td>849</td>
<td>930</td>
<td>54.7</td>
<td>0.55</td>
</tr>
<tr>
<td>wk 0-12</td>
<td>866</td>
<td>885</td>
<td>848</td>
<td>855</td>
<td>19.5</td>
<td>0.59</td>
</tr>
</tbody>
</table>
Effect of drinker management on water disappearance (L/pig/d)

Effect of drinker management on manure output (L/pig/d)
Water disappearance and manure output (L/pig/d)

Conclusions

- Grower/finisher pigs wasted 25% of water from well managed nipple drinker.
- High flow rate and low nipple height increased water wastage.
- Water disappearance (13%) and manure output (11%) were reduced by using the stepped nipple drinker.
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