CONTENT

1. Pig farming in Vietnam: status quo
2. Status quo of pig farming environmental pollution in Vietnam
3. Inventory survey
4. Stakeholder meeting
5. Future plan
1. Pig farming in Vietnam: status quo

- Contribution of livestock sector to the agri. sector output up to 26.3 (or 4.8% GDP), and expected to reach 42% by 2020.
- Pig production contributes about 71% of the sub-sector’s total

Generates 47% of employment

- Total population: 90 mil.

- Remarkable economic growth:
  - 7.5% annually in 1992-2007
  - 5.8% annually in 2008-2014

![Pie chart showing contribution to Vietnam’s GDP by Industry (2013)]
Pig Production in 2010 (Global Views)

Pig Production in 2010
(total production over the world: 109,186 thousands tonnes)

WEPA countries: 60% of world production

Vietnam: Top 6 in the world

Pig herd size per agrosystem

Pig Growth in Vietnam During 2000-2014

(Source: channuoivietnam.com)
# Trends in Pork Production by Farm Size in Vietnam

<table>
<thead>
<tr>
<th>Farm year</th>
<th>1-4 pigs (%)</th>
<th>5-19 pigs (%)</th>
<th>20-49 pigs (%)</th>
<th>50-99 (%)</th>
<th>pig 100 (%)</th>
<th>and over</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>65.0</td>
<td>28.0</td>
<td>4.0</td>
<td>1.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>37.5</td>
<td>37.0</td>
<td>13.0</td>
<td>4.5</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>25.0</td>
<td>35.0</td>
<td>17.0</td>
<td>6.0</td>
<td>17.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Agrocensus 2011 of General Statistic Department-VN
Traditional farming

4 mil. households
65-70% pig number
55-60% yield
Trend: reducing 5-> 10 yeas

Industrial farming

4.293 farms
30-35% pig number
40-45% yield
Environmental impact: low concern
⇒ unstable development
2. Status quo of pig farming environmental pollution in Vietnam
Wastewater:

a) Urine, organic compounds (COD/BOD, TN, N-NH$_4^+$ (amôni), TP)

b) Cleaning water (TSS, VSS, COD)

c) Drinking water: not significant.

Solid waste: manure + food excess

1.5-3.5 kg manure/day, and 10-50 litters of wastewater.

Emission:

a) Solid waste, wind circulation system in enclosed farm, wastewater.

b) Components: > 75 compounds = containing –N and – S such as NH$_3$, amin, mercaptan, H$_2$S and vaporable organic acids.

6 million tons of CO$_2$eq: annually by medium-sized pig farmers as a result of an estimated 73 million tons of pig waste disposed improperly into ponds, channels and sewerage or merely left to decay into fields each year.
Distribution of pollutants load in term of BOD, COD, SS, T-N and T-P in Binh Dinh Province (Source: MONRE, 2012)
Treatment methods in Vietnam

+ Biogas treatment: 30%
+ Waste Stabilization Ponds: 30%
+ Direct irrigation of crops, fish or shed to environment: 40%

Source: Du Le Hang (2010)
Another example of how manure is utilized in surveyed farm areas in Northern Vietnam

(Source: Wageningen University; La Van Kinh)
## Bio-products

<table>
<thead>
<tr>
<th>Name</th>
<th>The base</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deodorase</td>
<td>Extracted from herb</td>
<td>Reduce NH3</td>
</tr>
<tr>
<td>EM</td>
<td>Microorganism collection</td>
<td>Increase the absorbance of TA. reduce excretion DD through poop</td>
</tr>
<tr>
<td>EMC</td>
<td>Herbal, natural mineral substrate</td>
<td>Reduce NH3, H2S, SO2, detox TH</td>
</tr>
<tr>
<td>Kemzym</td>
<td>Enzyme</td>
<td>Increase the absorbance of TA. reduce excretion DD through poop</td>
</tr>
<tr>
<td>Pyrogreen</td>
<td>Natural biochem</td>
<td>Reduce NH3</td>
</tr>
<tr>
<td>Yeasac</td>
<td>Yeast Sacharomyces</td>
<td>Increase the absorbance of TA. reduce excretion DD through poop</td>
</tr>
<tr>
<td>Sarsapomin 30</td>
<td>Extracted from herb</td>
<td>Reduce NH3</td>
</tr>
</tbody>
</table>
Bio-padding
III. INVENTORY SURVEY
Objectives:
Evaluate the status quo of pig farming and waste management in 4 provinces below.

Scale:
Ha Nam, Hoa Binh, Nghe An, Ha Tinh

Involved by:
• Department of Natural Resources and Environment, Department of Agriculture and Rural Development
• 4 farm with size > 1000
• Local people

Timeline: 21-26 Dec 2015

Content:
- Surveying of the status quo of pig farming in 4 provinces
- Surveying of the status quo of wastewater treatment in 4 provinces.
- Surveying of the status quo of waste treatment in 4 provinces
- Community consultation.
The status quo in 4 provinces

Hòa Binh
Hà Nam
Hà Tĩnh
Nghệ An

pig number

2010 2011 2012 2013 2014 2015

0 200000 400000 600000 800000 1000000 1200000 1400000
## The status quo of wastewater treatment in 4 provinces

<table>
<thead>
<tr>
<th></th>
<th>Hòa Bình</th>
<th>Hà Nam</th>
<th>Nghệ An</th>
<th>Hà Tĩnh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater (m³/year)</td>
<td>2.815797,6</td>
<td>Urine: 410,990</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water used in cleaning: 1,972,752</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste (tấn/year)</td>
<td>na</td>
<td>378,110,8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waste water quality</td>
<td></td>
<td>Some parameters are exceeds Vietnamese standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poluted caution</td>
<td></td>
<td>Treatment system: not precisely operated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient technique with high nutrient content</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Biogas: water consuming, inefficient with bacteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Awareness, perception of farm holder on policy and law is low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No environmental officer specific to livestock farming.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate EIA farm (%)</td>
<td>10/34</td>
<td>8/20</td>
<td>100%</td>
<td>29/90</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+ 2 projects approval</td>
<td></td>
</tr>
<tr>
<td>Rate of farms completing wastewater treatment system to be approved (%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rate of farms having wastewater treatment system</td>
<td>Almost</td>
<td>80%</td>
<td>31/36</td>
<td>Almost</td>
</tr>
<tr>
<td>Inspection</td>
<td>20 farms (2015)</td>
<td>No letters of complaint</td>
<td>Commitment</td>
<td>2 inspections/year in cage of complaint</td>
</tr>
<tr>
<td>Violation handling</td>
<td>1 cage (2015)</td>
<td>7 cages (from 2010)</td>
<td>1 cage</td>
<td>na</td>
</tr>
</tbody>
</table>
The status quo of waste treatment in 4 farms

4 farms:
- **Hòa Bình Xanh**: Hòa Bình
- **Bồ Đề**: Hà Nam
- **Tam Thái**: Nghệ An
- **Mitraco**: Hà Tĩnh
Hòa Bình Xanh FARM

cage 1

cage 2

cage 3

cage 4

cage 5

cage 6

cage 7

cage 8

cage 9

cage 10

cage 11

Biogas

Treatment

Output
Tam Thái FARM

- Stabilization pond
- Biogas
- Grass pond
- Bio pond
- Cage 1
- Cage 2
Wastewater from cages

Biogas
(70 x 35 x 5 m)

04 bio pond
(60 x 40 x 3.5)

Environment

Clo

Mitraco FARM
## Waste Inventory

<table>
<thead>
<tr>
<th></th>
<th>Hòa Bình Xanh</th>
<th>Bò Đề</th>
<th>Tam Thái</th>
<th>Mitraco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poop (g-1 per day)</td>
<td>-</td>
<td>-</td>
<td>268.8</td>
<td>167-186</td>
</tr>
<tr>
<td>Wastewater (m³ per day)</td>
<td>45</td>
<td>50</td>
<td>60</td>
<td>150</td>
</tr>
</tbody>
</table>
# Biogas tank

<table>
<thead>
<tr>
<th></th>
<th>Hòa Bình Xanh</th>
<th>Bồ Đề</th>
<th>Tam Thái</th>
<th>Mitraco</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size (m)</strong></td>
<td>10 x 25 x 4</td>
<td>60 x 25 x 4,5</td>
<td>60 x 40 x 5</td>
<td>75 x 30 x 5</td>
</tr>
<tr>
<td><strong>Use of Emission from Biogas</strong></td>
<td>Run 02 electricity generator 14 hours</td>
<td>Cooking and burning</td>
<td>Cooking and burning</td>
<td>Run 01 electricity generator 8 hours</td>
</tr>
</tbody>
</table>
Sampling analysis

- Sampling site: front side of Biogas and rear side of treatment system
- Time points: 2 twice per 2 continuous days
- Measurement of wastewater analysis:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>TCVN 2655-2 : 1978</td>
</tr>
<tr>
<td>COD</td>
<td>APHA, 5220 D Closed Reflux, Colorimetric method</td>
</tr>
<tr>
<td>BOD</td>
<td>APHA, 5210 B. 5-day BOD Test</td>
</tr>
<tr>
<td>TP</td>
<td>TCVN 6202:1996</td>
</tr>
<tr>
<td>TSS</td>
<td>APHA, 2540D. Total suspended Solids dried at 103-105°C</td>
</tr>
<tr>
<td>VSS</td>
<td>APHA, 2540 E. Fixed and Volatile Solids Ignited at 550°C</td>
</tr>
<tr>
<td>N-NH₄⁺</td>
<td>APHA.4500 NH3 F.Phenat Method</td>
</tr>
<tr>
<td>TN</td>
<td>TCVN 6624-1:2000</td>
</tr>
</tbody>
</table>
BOD content in the output

COD content in the output

Unit: mg/L
TSS context in the output

Unit: mg/L

TP context in the output
- BOD, TSS in wastewater of simply system (Biogas + bio-ponds) in 4 farms: in range of QCVN 40
- COD, TN, TP in wastewater exceed QCVN 40.
- Low productivity of treatment

**APPROPRIATE pig wastewater MODEL with FARM development:**
eco-friendly, not expensive
IV. STAKEHOLDER MEETING
“Livestock Waste Management in Vietnam”
- **Time:** 18\textsuperscript{th} January 2016, Hanoi
- **Participants:** 50 people
- **Objective:**
  - Disseminate and share results and information gained from implementation of action program
  - Deepen understanding on present situation and challenges of livestock wastewater management and treatment methods, etc. in Vietnam
  - Share information on livestock wastewater treatment using methane fermentation in Japan and other countries
**Results**

**Current issues in managements**
- Incomplete system of legal documents, lack of specific guidelines on the management of pig production environment.
- No sewage QCVN for livestock
- Inadequate regulations on zoning of concentrate farms (distance from breeding areas to residential areas, not parallel with social and economic development plan)
- Functions and duties of the Ministry of Natural Resources and Environment and the Ministry of Agriculture and Rural Development are overlapping
- Human Resources Environmental Management at DONRE is weak and lack of expertise.
- No technical guidelines on waste disposal of pig production for managers and farm owners
- No provisions to encourage the pig farm having good practice solutions for environmental protection
**Capital:**
- High construction cost for wastewater treatment system;
- High construction cost for breeding houses, suckling pigs;
- Difficultly access for bank loans, Environmental protection fund, state supporting capital policies

**Technique:**
- Biogas system build by themselves without standard technical guideline;
- Non concrete implementing guideline;
- Insufficient conditions to frequently monitoring;
- Ineffective technical treatment;
- Biogas used ineffectively.

**Awareness:**
- Low awareness in livestock environmental protection;
- Lack of information of environmental law and policies.
- Lack of concrete guiding document for livestock environmental management
IV. FUTURE PLAN
POLICY

- Strengthen the dissemination and popularization of Laws and regulations in environmental protection facilities for livestock
- Issue Vietnamese Standard for livestock wastewater
- Strengthen the coordination between MONRE and MARD
- Develop investment policies to support waste water treatment system as well as encouraging expansion model scale pig breeding farm
- Complete pig farm development plan
- Develop encouraging policies for products produced by well environmental protection practiced farms.
- Research, introduce and guide applying low cost and high effective wastewater treatment technique model.
- Research to improving biogas treatment system and bio – padding.
- Develop technical guidelines for livestock waste water management for environmental managers and farmers.
- Enhance capacity of local and central environmental managers and farmers through workshop, training and technical guidelines.
INTERNATIONAL COOPERATION

- Share management experience of pig farm waste in Vietnam with member countries of WEPA

- Learn experience of livestock waste management policies and technique of member countries of WEPA.

- Propose study tour for local and central environmental managers and related agencies in member countries of WEPA to learn experience of livestock waste management.
THANK YOU FOR YOUR ATTENTION!
<table>
<thead>
<tr>
<th>Region</th>
<th>Per capita meat consumption (kg)</th>
<th>Per capita milk consumption (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>16</td>
<td>33</td>
</tr>
<tr>
<td>Other East Asian</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td>India</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Other South Asia</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Developing world</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>Developed world</td>
<td>74</td>
<td>76</td>
</tr>
</tbody>
</table>
Distribution of Pigs Nationwide 2014

(Source: channuoivietnam.com)
## Statistic Data of Pig Production in Vietnam

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Unit</th>
<th>2001</th>
<th>2005</th>
<th>2006</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Av Gro rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sow</td>
<td>Head</td>
<td>2.947.008</td>
<td>3.882.328</td>
<td>4.337.977</td>
<td>4.043.365</td>
<td>4.025.551</td>
<td>3.916.035</td>
<td>2.4</td>
</tr>
<tr>
<td>Fattening pig</td>
<td>Head</td>
<td>18.679.404</td>
<td>23.421.871</td>
<td>22.433.315</td>
<td>22.911.251</td>
<td>22.739.122</td>
<td>22.269.240</td>
<td>1.48</td>
</tr>
<tr>
<td>Pork proportion</td>
<td>%</td>
<td>76.3</td>
<td>81.4</td>
<td>81.5</td>
<td>74.3</td>
<td>74.0</td>
<td>74.2</td>
<td>-0.23</td>
</tr>
<tr>
<td>Sow/total herd</td>
<td>%</td>
<td>13.54</td>
<td>14.15</td>
<td>16.15</td>
<td>16.28</td>
<td>15.19</td>
<td>14.91</td>
<td>0.81</td>
</tr>
<tr>
<td>Finisher/sow/year</td>
<td>Pig/Sow</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>12.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Average finishing weight/year</td>
<td>Kg/Head</td>
<td>66.6</td>
<td>63.1</td>
<td>63.7</td>
<td>67.7</td>
<td>65.6</td>
<td>67.0</td>
<td>0.05</td>
</tr>
</tbody>
</table>

*Source: Restructure of livestock production for the sustainable trend (MARD)*
### Calculation of N Production in the Manure of Sows with Piglets

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Dimension</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live piglet production</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Weaning weight piglets</td>
<td>7.5 kg</td>
<td>live weight</td>
</tr>
<tr>
<td>Final weight piglets</td>
<td>25 kg</td>
<td></td>
</tr>
<tr>
<td><strong>Nitrogen intake</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed conversion piglets</td>
<td>1.80 kg kg(^{-1})\ year(^{-1})</td>
<td>kg feed per kg gain</td>
</tr>
<tr>
<td>Feed intake sow</td>
<td>1140 kg sowing(^{-1})\ year(^{-1})</td>
<td>dry matter</td>
</tr>
<tr>
<td>Feed intake piglets</td>
<td>630 kg dry matter(^{-1})</td>
<td></td>
</tr>
<tr>
<td>N content of sow feed</td>
<td>2.60 %</td>
<td>of dry matter</td>
</tr>
<tr>
<td>N content of piglet feed</td>
<td>3.00 %</td>
<td>of dry matter</td>
</tr>
<tr>
<td>N intake sow</td>
<td>29.6 kg year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>N intake piglets</td>
<td>18.9 kg year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Total N intake</td>
<td>48.5 kg year(^{-1})</td>
<td>per sow + piglets</td>
</tr>
<tr>
<td><strong>Retention of nitrogen</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liveweight gain sow</td>
<td>40 kg year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Liveweight production piglets</td>
<td>500 kg year(^{-1})</td>
<td>per sow</td>
</tr>
<tr>
<td>N content gain sow</td>
<td>2.50 %</td>
<td>of live weight</td>
</tr>
<tr>
<td>N content gain piglet</td>
<td>2.50 %</td>
<td>of live weight</td>
</tr>
<tr>
<td>N retention in sow</td>
<td>1.0 kg year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>N retention in piglets</td>
<td>12.5 kg year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Total N retention</td>
<td>13.5 kg year(^{-1})</td>
<td>per sow-place</td>
</tr>
<tr>
<td><strong>Nitrogen excretion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per sow</td>
<td>28.6 kg year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>per piglets</td>
<td>6.4 kg year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>per sow + piglets</td>
<td>35.0 kg year(^{-1})</td>
<td>per sow-place</td>
</tr>
<tr>
<td><strong>Nitrogen losses in building and manure storage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N loss building</td>
<td>21 %</td>
<td>of N excreted</td>
</tr>
<tr>
<td>N loss manure storage</td>
<td>5 %</td>
<td>of N stored</td>
</tr>
<tr>
<td>total N loss</td>
<td>25.0 %</td>
<td>of N stored</td>
</tr>
<tr>
<td>per sow</td>
<td>7.2 kg N year(^{-1})</td>
<td>of N excreted</td>
</tr>
<tr>
<td>per piglets</td>
<td>1.6 kg N year(^{-1})</td>
<td>of N excreted</td>
</tr>
<tr>
<td>per sow + piglets</td>
<td>8.8 kg N year(^{-1})</td>
<td>per sow-place</td>
</tr>
<tr>
<td><strong>Nitrogen in manure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per sow</td>
<td>21.5 kg N year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>per piglets</td>
<td>4.8 kg N year(^{-1})</td>
<td></td>
</tr>
<tr>
<td>per sow + piglets</td>
<td>26.3 kg N year(^{-1})</td>
<td>per sow-place</td>
</tr>
</tbody>
</table>

### Calculation of N Production in the Manure of Growing Finishing Pigs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Dimension</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production cycle</td>
<td>115</td>
<td>Days</td>
</tr>
<tr>
<td>Empty period</td>
<td>7</td>
<td>Days</td>
</tr>
<tr>
<td>Starting weight</td>
<td>25 kg</td>
<td>Live weight</td>
</tr>
<tr>
<td>Slaughter weight</td>
<td>105 kg</td>
<td>Live Weight</td>
</tr>
<tr>
<td>Rounds per year</td>
<td>3.0</td>
<td>-</td>
</tr>
<tr>
<td><strong>Nitrogen intake</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed conversion piglets</td>
<td>2.90 kg kg(^{-1})\ year(^{-1})</td>
<td>kg feed per kg gain</td>
</tr>
<tr>
<td>Total feed intake</td>
<td>232 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Feed intake per phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1</td>
<td>232 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>0 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td></td>
</tr>
<tr>
<td>N content of feed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1</td>
<td>2.80 %</td>
<td>of dry matter</td>
</tr>
<tr>
<td>Phase 2</td>
<td>0 %</td>
<td>of dry matter</td>
</tr>
<tr>
<td>N intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1</td>
<td>6.50 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>0.00 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Total N intake</td>
<td>6.50 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td>per cycle</td>
</tr>
<tr>
<td><strong>Retention of nitrogen</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liveweight production piglets</td>
<td>80 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td>of live weight</td>
</tr>
<tr>
<td>N content</td>
<td>2.50 %</td>
<td>of live weight</td>
</tr>
<tr>
<td>N retention</td>
<td>2.00 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td>per cycle</td>
</tr>
<tr>
<td><strong>Nitrogen excretion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per animal</td>
<td>4.5 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td>per cycle</td>
</tr>
<tr>
<td>Per animal place</td>
<td>13.5 kg kg (animal place)(^{-1})\ year(^{-1})</td>
<td>3 rounds per year</td>
</tr>
<tr>
<td><strong>Nitrogen losses in building and manure storage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N loss building</td>
<td>21 %</td>
<td>of N excreted</td>
</tr>
<tr>
<td>N loss manure storage</td>
<td>5 %</td>
<td>of N stored</td>
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<tr>
<td>total N loss</td>
<td>25.0 %</td>
<td>of N stored</td>
</tr>
<tr>
<td>Per animal</td>
<td>1.1 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td>per cycle</td>
</tr>
<tr>
<td>Per animal place</td>
<td>3.4 kg kg (animal place)(^{-1})\ year(^{-1})</td>
<td>3 rounds per year</td>
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<td><strong>Nitrogen in manure</strong></td>
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<tr>
<td>Per animal</td>
<td>3.4 kg kg dry matter(^{-1})\ animal(^{-1})</td>
<td>per cycle</td>
</tr>
<tr>
<td>Per animal place</td>
<td>10.1 kg kg (animal place)(^{-1})\ year(^{-1})</td>
<td>3 rounds per year</td>
</tr>
</tbody>
</table>

Note: Shaded cells are those requiring input data for the livestock type and production system; other cells contain default data (which can be edited if specific information is available) or output data.
Classification of Pigs in Vietnam

Piglets/suckling pigs

10–15 kg at 40–45 days old

Growers

20–35 kg at 70–80 days old

Finished pigs (or slaughter pigs)

80–130 kg

- Reproduce on farm or buy from other small farmers.
- Be supplied by large commercial farms, state breeding centres and nucleus farms of animal feed/food companies.

- Growers are not as widely used by pig farmers because today not many farmers practise a grow-to-finish (fattening) pig production system.

- Normally undergo four to five months of fattening, and weight varies greatly depending on breed and market demand.
- Usually move from farmers to collector, slaughterhouse, trader, or even individual consumers.
Pollutant loads

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Hòa Bình Xanh</th>
<th>Bồ Đề</th>
<th>Tam Thải</th>
<th>Mitraco</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Input (kg/day)</td>
<td>Output (kg/day)</td>
<td>Input (kg/day)</td>
<td>Output (kg/day)</td>
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<tr>
<td>COD</td>
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<td>7,49</td>
<td>305,00</td>
<td>5,68</td>
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<td>BOD</td>
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<td>TP</td>
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<td>0,10</td>
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<td>TSS</td>
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<td>N-NH₄⁺</td>
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<td>2,91</td>
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<tr>
<td>TN</td>
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</table>