Assessing three nitrogen use performance indicators for pig supply chains in East and Southeast Asia

Aimable Uwizeye, Pierre Gerber, Rogier Schulte, Imke de Boer
LEAP PARTNERSHIP


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Melbourne, Australia
Outline

• Goal

• Nitrogen use performance indicators

• Results for Pig supply chains

• Take home messages
Key figures on livestock

- 25% of the protein consumed
- 1/4 of people depend on livestock
- 40% of the global GDP of agriculture
- +70% demand for animal products by 2050

Land use:
- 25% Pastures
- 25% Feed crops
- 5% Human - induced greenhouse gas emissions

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Pig supply chains are developing rapidly with an average growth of 3%
1. Goal

Evaluate the Nitrogen use performance indicators for pig supply chains in ESEA.
2. N use performance indicators?

- Life cycle approach
- Definition of system boundary (cradle to primary processing)
- Considerations of all N flows including crop residues and manure recycled
- All materials exported are considered as co-products e.g. Manure, maize stover
- Need for a hotspot indicator
N use performance framework

Loss Pathway:
- Gaseous Loss: denitrification ($N_2O$), volatilization ($NH_3$)
- Leaching: $NO_3^-$, $NH_4^+$, Organic $N$, $PO_4^{3-}$

Migration into the environment and impacts

Total Losses

Co-products e.g. grain, oil
Co-products Other animals species
Co-products e.g. Whey, hides, renderables

Crop and Pasture Production

Animal Production

Fossil fuel

Unprocessed products

Consumer

Migration into the environment and impacts

Uwizeye et al., 2016

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## Supply-and-use matrix

**PROD:** Products of unit processes from the system

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**INP:** Inputs to the unit processes (crop, animal, process) from the system

**RES:** Resources mobilization from the nature other sector “new N”

**SC:** Change in stock

**NNB:** Loss from unit processes
N use performance indicators

**Stage-NUE**

\[
NUE_i = \frac{PROD_i + SC_i}{INP'_i + RES_i}
\]

**Life-cycle-NUE**

\[
RES^* = RES \cdot \left( PROD - INP + SC \right)^{-1}
= RES \cdot A^{-1}
\]

\[
\text{Life_cycle_NUE} = 1/RES^*_\text{processing}
\]

**Life-cycle Net nitrogen balance**

\[
\text{Life-cycle-NNB}_i = \frac{\sum NNB_i \times AF_i}{A_i}
\]

**Nitrogen hotspot index**

\[
NHI_i = \frac{\sigma(\text{NNBi})}{\mu(\text{NNBi})} \times 100
\]
Backyard pig supply chains

- 56% of total pig population
- Scavenging and swill from households.
- Poor MMS
- Livelihoods and food security
Intermediate Pig supply chains

- 24% of total pig population
- Imported feed and swill from households.
- Poor MMS
- Market oriented
Industrial Pig supply chains

- 20% of total pig population
- Imported feed.
- Confined
- Developed MMS
- Market oriented (export)
Take home message

• Manure management system, production inefficiencies, and animal health are relatively the drivers of poor N use performance indicators in backyard and intermediate supply chains;

• Export of manure to no-feed crop may relatively increase the efficiency of industrial pig supply chains as the subsequent losses are not allocated to the animal production;

• Combination of three indicators, “NUE”, “NHI”, “NNB” can facilitate the design of smart improvement interventions of N use management

• Large potential improvements in N management at the crop production and manure management stage;
Aimable UWIZEYE, PhD Fellow, Wageningen University
FAO – AGAL – LEAP Partnership
Livestock & Environment Analyst
E-mail: aimable.uwizeye@fao.org
Twitter: aimableuw