DETERMINATION OF EMISSION FACTORS IN MANURE MANAGEMENT FROM PIG PRODUCTION

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Problem statement

➢ Manure management systems are a key factor influencing greenhouse gas (GHG) emissions in pig production. In Vietnam, the most common waste management practices in finishing pig production involve the storage of solid manure in pits or the storage of liquid manure in tanks, lagoons, or ponds.

➢ The type and magnitude of GHG emissions from manure management depend on several factors, including storage duration, management practices, temperature, and manure composition. In addition, GHG emissions are also affected by the pig farm scale and differences in feeding regimes, which lead to variations in manure characteristics.

➢ Determining GHG emission factors (Efs) from pig manure with different manure managements, farming scales and temperature conditions is essential to ensure increased accuracy in GHG inventories.

The solution/Innovation

Data gaps were identified through rapid surveys conducted at selected pig farms.

➡ Storage duration of solid and liquid manure

➡ Manure managemt systems

➡ Chemical composition of solid and liquid manure

Simulation experiment to determine actual emission factors (EFs) from solid and liquid manure storage in pig production during winter and summer

Preliminary experiment for determining the appropriate daily gas sampling time

Method

Winter   Summer

Solid/liquid manure collecting

Small scale   Medium scale   Large scale

Farming system

Daily gas sampling (8:00 – 10:00 AM)

Static chamber

Gas chromatography (GC)

To identify:
➢ Daily emission flux of GHG from solid/liquid manure storage in different farm scales in winter and summer by simulation experiment
➢ Emission factor (EF) of GHG from solid/liquid manure storage

Experimental equipments

Static chamber

GC System

| Rapid survey | Preliminary Exp. | Collected manure at pig farms | Daily gas sampling |

Photograph by VIAVS team
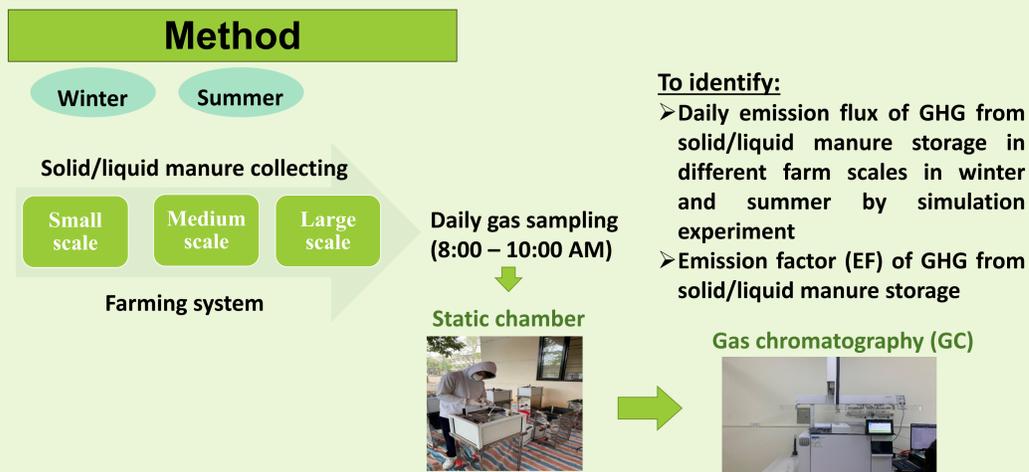
Scalability and regional relevance

➢ The outcomes of this study demonstrate strong scalability and regional relevance.

➢ The methodology and emission factors developed can be applied to different pig production systems and extended to other regions with comparable climatic and manure management conditions.

➢ These results provide valuable scientific evidence for improving greenhouse gas inventories and mitigation strategies in livestock production.

Key results/impacts

Manure types	Farm scale	CH_4 (kg/kg VS)			N_2O-N (kg/kg TN)		
		Winter	Summer	IPCC (2019)	Winter	Summer	IPCC (2019)
Solid	Small	0.0002[b]	0.0015[b]	0.0097-0.0151	0.1295[a]	0.0007	0.005-0.010
	Medium	0.0001[b]	0.0110[a]		0.0031[b]	0.0010	
	Large	0.0012[a]	0.0028[b]		0.0001[b]	0.0001	
	P-value	0.001	0.007		<0.0001	0.078	
Liquid	Small	0.0462	0.1436[b]	0.0696-0.2201	0.0004[a]	0.0007	0-0.005
	Medium	0.0189	0.0242[c]		0.0003[ab]	0.0001	
	Large	0.0070	0.2622[a]		0.0002[b]	0.0002	
	P-value	0.078	<0.0001		0.018	0.182	

➢ The CH_4 emission factor in summer was 6–10 times higher than in winter. For solid manure, the highest CH_4 EF was observed in medium farms, which was 6.5 times higher than that of small farms and 2.8 times higher than that of large farms. For liquid manure, the highest CH_4 EF was recorded in large farms, which was 41% higher than in small farms.

➢ The N_2O EF from solid manure in summer was significantly higher than in winter. However, the N_2O EF from liquid manure was similar between the two seasons. For both solid and liquid manure, the highest N_2O EF was observed in small farms.

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