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Sustainable Feeds by adding Green to Global plate

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Charoen Pokphand Group committed to sustainable business

In 2022, Charoen Pokphand Group established the 2030 Sustainability Strategy, Goals, and Indicators for all business groups around the world.

Goal of 2030 is Carbon Neutrality and 2050 is Net Zero.

Trend and Challenge

Projected regional population (billions)

	2000	2050	Growth	%/yr
Asia	3.7	5.3	+43%	+0.7%
Africa	0.8	2.5	+212%	+2.3%
Europe	0.7	0.7	0%	0.0%
Latin America & the Caribbean	0.5	0.7	+40%	+0.7%
Northern America	0.3	0.4	+33%	+0.6%
Oceania	0.03	0.06	+100%	+1.4%
World	**6.1**	**9.7**	+60%	+0.9%

These models use trend-based-assumptions showing projected regional growth and chicken meat production

Chicken Meat

Production (mil.MT)	% of the world	2020	2021	2022	2023	2024f	YoY
United States	21%	20.3	20.4	21.0	21.1	21.2	0.5%
Brazil	15%	13.9	14.5	14.5	14.9	15.1	1.0%
China	13%	14.6	14.7	14.3	14.3	13.9	-3.0%
European Union	11%	11.0	10.8	10.9	11.2	11.2	0.4%
Thailand	3%	3.3	3.2	3.3	3.5	3.5	1.2%
Others	58%	56.9	57.8	58.9	58.6	59.7	1.8%
Total	100%	99.7	101.1	101.8	102.4	103.3	0.9%

ที่มา: USDA, Livestock and Poultry: World Markets and Trade [Jan 24]

Farm and Animal Welfare

Antibiotic growth promoter (AGP)

Animal welfare in the EU

Source: European Commission of Animal Welfare

CP Foods pledges to improve free antibiotic meat products

This effort aims to improve animal health and reducing the antibiotics resistance in food products

Sustainable Feeds

Sustainable feeds

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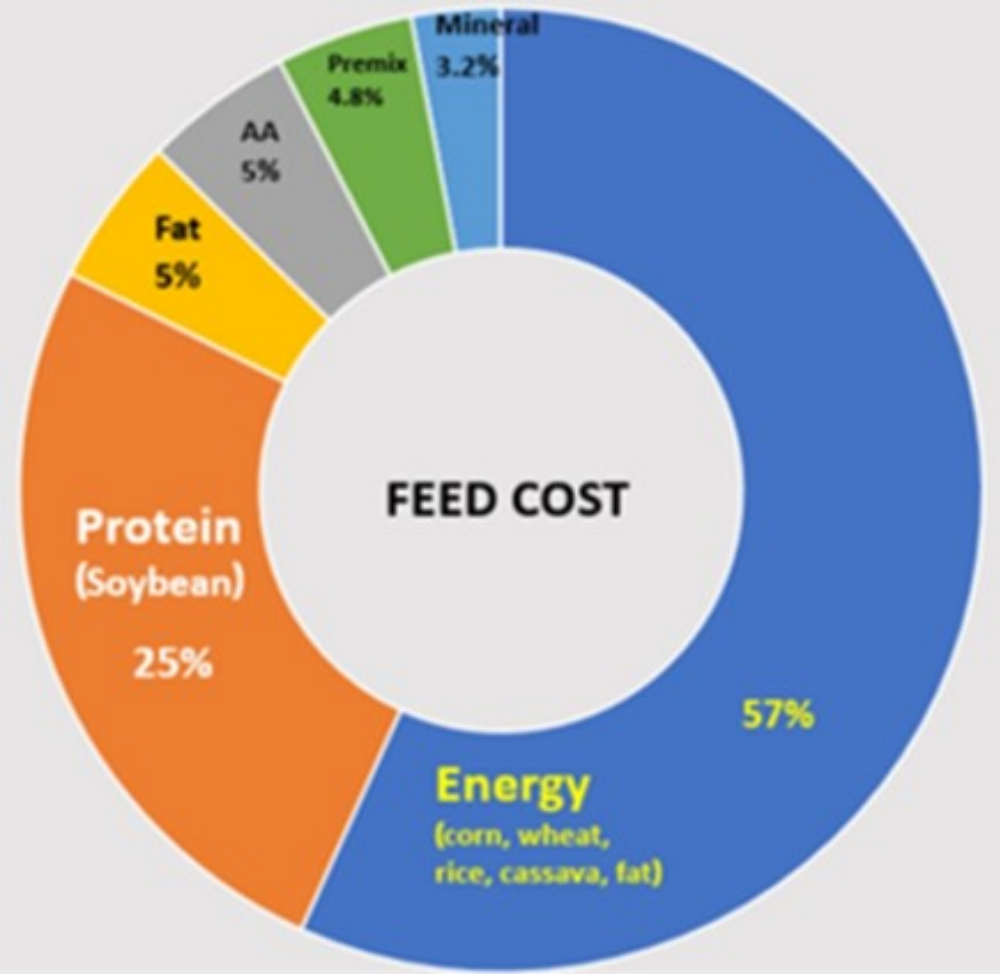
Least cost feed formulation, Good performance and friendly with environment



Key Points

Dietary Energy Sources
(COST) = Net Energy

Dietary Protein Sources
(COST) = SID AA basis

90-95%

(1) Friendly environmental feeds

(2) Herbal Product as feed additive.

Friendly environmental feeds

Chicken Feed is the hot spot for GHG emissions

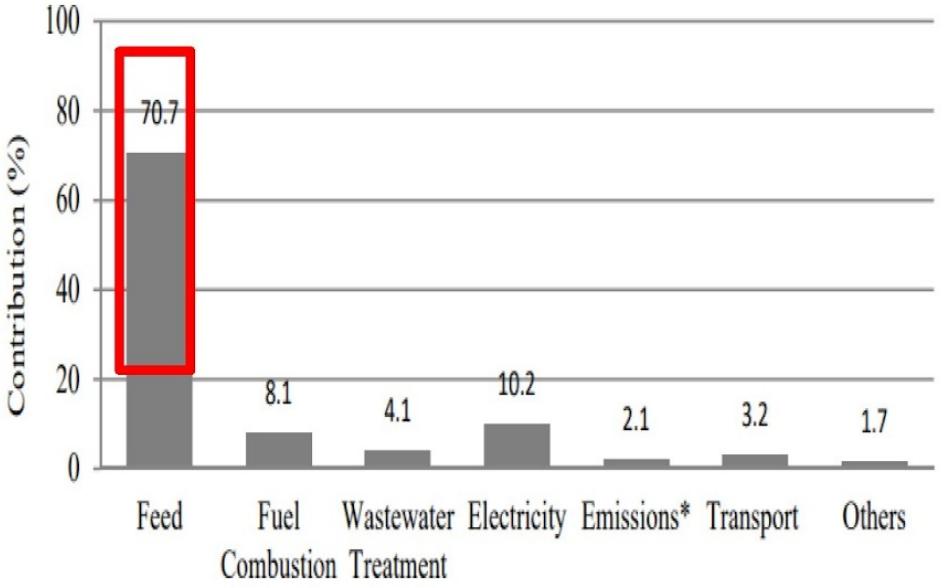
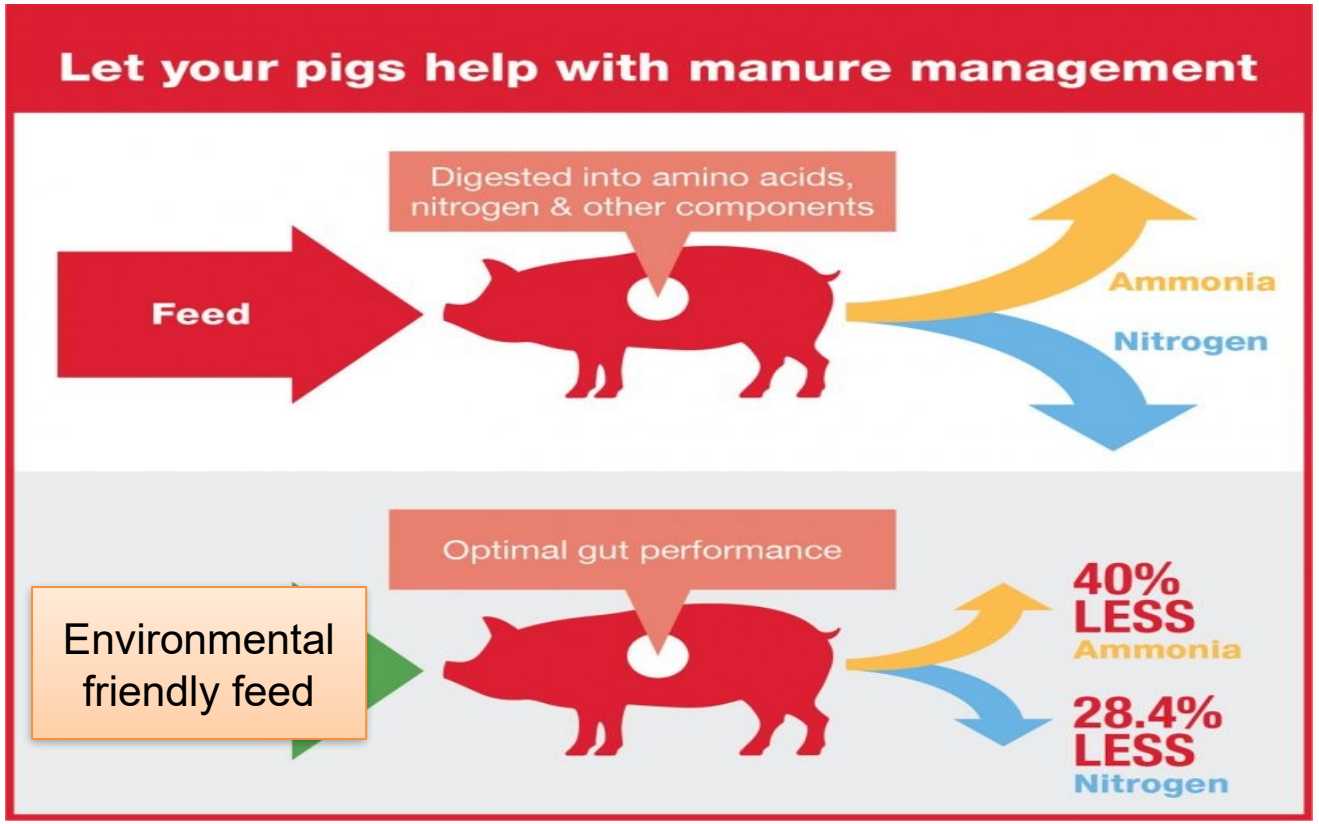


Figure 4. Contribution to GHG emissions from major sources within the processes evaluated in chicken meat production. * Emissions from enteric fermentation and on-farm manure management.

Friendly environmental feeds

- Feeds can reduce Nitrogen in feces
- They can reduce nearly 40 less ammonia and 28.4 % less nitrogen from manure.



Environmental Friendly Feeds

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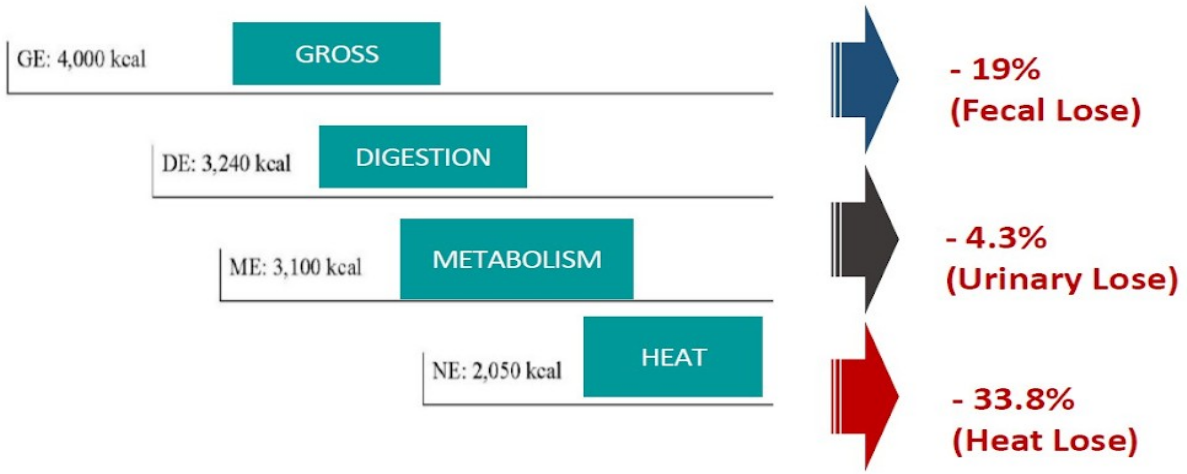
GE
(4,000 kcal; 100%)

NEp
(1,250 kcal; 31%)

Feces	Urine	Heat increment	NE_m	NE_p
760	140	1,050	800	1,250



- 19% (Fecal Lose)
- 4.3% (Urinary Lose)
- 33.8% (Heat Lose)

Approximate energy utilization of growing pigs fed a corn-soybean meal-based feeds (Kil, 2008). NE_p = Netenergy for production.

Net Energy

Asian-Australas J Anim Sci. 2013 Sep; 26(9): 1205–1217.

Least Cost Feed Formulation

Growing pig (As fed) 50-75kg	Amount
Corn	77.64
SBM (46% cp)	15.31
Palm oil	2.11
Rice bran (full fat)	1.80
MDCP (P-22%)	0.92
Limestone	0.94
Salt	0.30
DL-Met	0.08
L-Thr	0.14
L-Lys 78%	0.46
Premix	0.25
Total in diet	100
Cost/kg	14.2

Total AA balance		SID AA balance	
Lys/Lys	100	Lys/Lys	100
Met/Lys	31.42	Met/Lys	29.71
Met+Cys/Lys	52.38	Met+Cys/Lys	56.89
Thr/Lys	65.20	Thr/Lys	62.19
Trp/Lys	13.80	Trp/Lys	12.98

Total AA Balance STD		SID AA Balance STD	
Lys/Lys	100	Lys/Lys	100
Met/Lys	28.86	Met/Lys	28.23
Met+Cys/Lys	58.76	Met+Cys/Lys	56.47
Thr/Lys	65.97	Thr/Lys	61.17
Trp/Lys	17.52	Trp/Lys	17.64

		Different%		
GE kcal/kg	3889.50			
DE kcal/kg	3381.25	13.06		
ME kcal/kg	3271.74	3.23		
NE kcal/kg	2543.80	22.24	Total Energy Lose	38.55%
Fat%	5.800			
CP %	13.80			
Lys%	0.965			
SID Lys%	0.888	7.91	SIDLys/total Lys	
Met%	0.303			
SID Met%	0.286	5.43	SIDMet/total Met	
Met+Cys%	0.558			
SID Met+Cys%	0.505	9.42	SIDMet+Cys/total Met+Cys	
Thr%	0.629			
SID Thr%	0.552	12.16	SIDThr/total Thr	
Ca%	0.600		Protein Lose	10%
Total P%	0.519			
Avail. P%	0.285	45.06	Total P/Avail.P	
Ca/Avail.P	2.102			
DEB	141.53			
Crude fiber%	2.896			
NDF%	10.69			
ADF%	3.398	68.21	NDF/ADF	
Lignin%	0.561			
NSPi%	9.758			
Starch%	50.85	88.59	Starch/fat	
Total sugar%	2.788			
Insoluble ash%	0.100			
Moisture%	12.71			
Hemicellulose (NDF-ADF)	7.293			
Cellulose (NDF-Lignin-Hemicellulose)	2.836			
Total Ash	2.747			
Total	**99.39**			

Protein (Lys):Energy ratio

GHG Mitigation Potentials
in the livestock sector

nature climate change

REVIEW ARTICLE

Greenhouse gas mitigation potentials in the livestock sector

Mitigation potentials

1. Technical and management interventions
   - Use of feed additives
   - Improve feed digestibility
   - Soil carbon sequestration in grasslands
2. Increased livestock and crop/pasture productivity
   - Animal productivity and health
   - Avoid deforestation due to intensification
3. Moderation of demand for livestock products
   - The production of beef protein requires about 50 times more land than the production of vegetable proteins, and GHG emissions excluding land-use change are about 100 times higher.
   - The 2030 mitigation potentials for animal GHG emissions at unit costs of US$20, US$50 and US$100 per tCO_2e were estimated to be 175, 200 and 225 $MtCO_2$ yt-1, respectively

Herbal product as Feed additives

Feed Additives

- Use of Methane Inhibitors
- Use of Herbal extracts
- Use of Bee propolis extract
- Use of Saponins and Yeast
- Use of Ionophores
- Use of Organic acids
- Use of Exogenous enzymes
- Use of Nanoparticles
- Use of Algae

Phytogenic Feed Additive (Supplement)

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Phytogenics are a group of natural and non-antibiotic growth promoters used as feed additives, contain a large number of substances with antimicrobial, antiviral and antioxidant activities.

The potential benefits of using phytogenics in poultry nutrition are: increased deed intake, stimulation of digestion, increased growth performance, reduced incidence if disease, improved reproductive parameters, improved feed efficiency, increased profitability and reducing poultry house emissions.

Preference for Phytogenics without chemicals

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	Essential Oils/Extracts	NR-SBP*
* Process	Solvent Extraction or Distillation	No such process
Active compounds	2 to 3	Many
Mode of Action	Single Target	Multiple Target
Cost	Very High	Low
CFP	Very High	Very Low

*NR-SBP, which is a registered Trademark concept of Natural Remedies Pvt Ltd.
It constitutes of a category of Phytogenics which is different from Essential oils & extracts

Relative Feed additive (supplement) to sustainable feed

Feed supplement has 2 effects to sustainability and environment.

- *Direct effect when NR-SBP replace synthetic choline chloride can reduce carbon emissions.*
- *Performance Improvement effect uses for antioxidant, antistress and adaptogenic.*

Impact on Carbon Footprint due to Greener alternative of choline chloride

Impact Category	Unit	NR-SBP Natural choline	Synthetic Choline Chloride-60%
Global Warming Potential	kg CO_2 eq	579	1,020
Freshwater Eutrophication	kg P eq	0.144	0.204
Terrestrial Acidification	kg SO_2 eq	2.45	3.41
Mineral resource scarcity	kg Cu eq	0.495	34.7
Water consumption	m^3	4.06	2.43
Freshwater ecotoxicity	kg 1,4-DCB	8.69	18.2
Human carcinogenic toxicity	kg 1,4-DCB	5.27	244

CFP Reduction by replacing Choline Chloride with NR-SBP

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NR-SBP Green choline Carbon Footprint is 0.579kg CO_2e per kg

C.P Group Has Contributed Towards Reducing

56,805,220 Kg CO_2e in 2023

(Carbon Dioxide Equivalent)

By Using NR-SBP Green choline for complete Choline chloride replacement

Source: Kolin Plus Life Cycle Assessment report NRPL

Methane reduction by NRSBP

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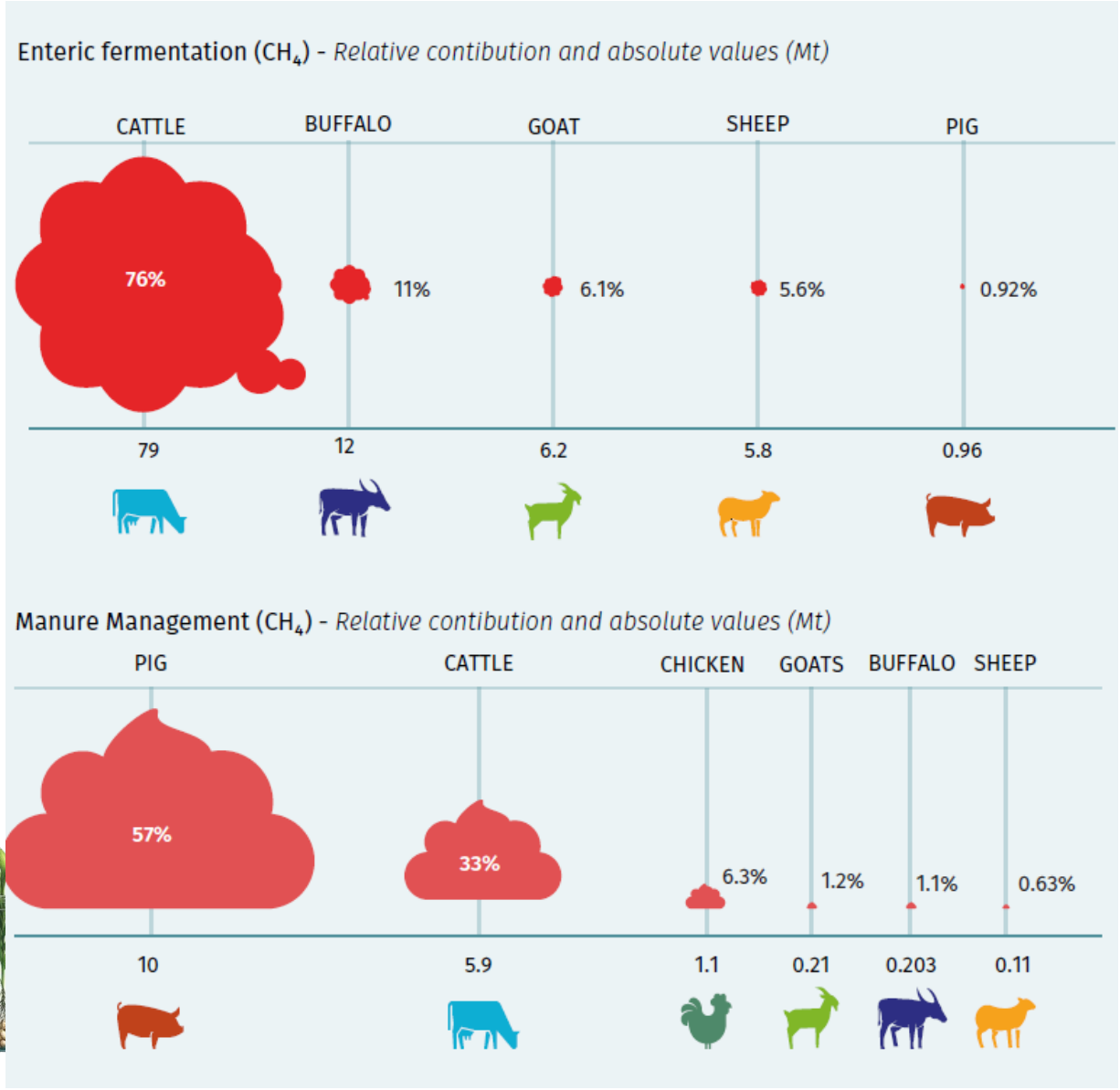
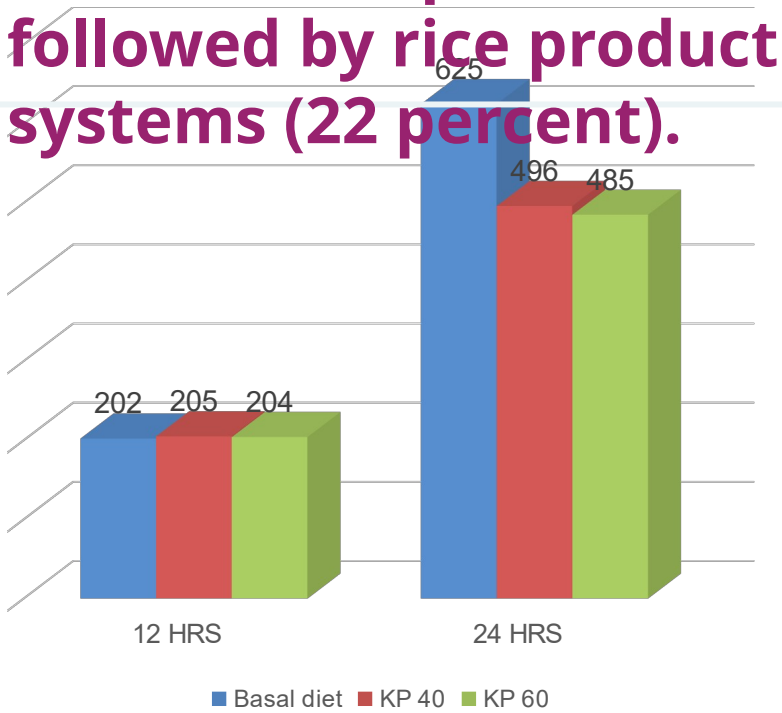


. AgriculturalCH4 emissions predominately stem from livestock (78 percent), followed by rice production systems (22 percent).



NR-SBP Green choline reduced Methane production by **20%** in 48 hrs

Source:RUSITEC-TANUVAS Kolin Plus

Natural adaptogen and defence

1. *Emblica officinalis*

Emblica officinalis fruit is listed as feed material in the Fe Material Register (ID 002004) in dried and powdered form.

2. *Ocimum sanctum*

Ocimum sanctum is listed as feed material in the Feed Material Register (ID 001476) as crude herb, dried and powdered.

3. *Withania somnifera*

Withania somnifera is listed as feed material in the Feed Material Register (ID 001480) as crude herb, dried and powdered.

NR-SBP cortisol reduction

NR-SBP played a pivotal role in reducing stress & aggressiveness in Swine.

NR - Adaptogen able to reduce 50% cortisol level in 4.8 million pigs in 2023.

Reference is available on request**

https://www.efsa.europa.eu/en/infographics/welfare-pigs-farm

Summary

It is possible to produce sustainable feeds and can achieve Carbon Neutrality and Net Zero. These feeds will be Green feeds which means that we shall increase natural ingredients or herbal feed supplement into feed formulas. While nutritionist control feed formulas by least cost and performance in the same time over nutrients in manure will been controlled.

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Muchas Gracias
Khob Khun Khap

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