Evaluation of feed substitute components

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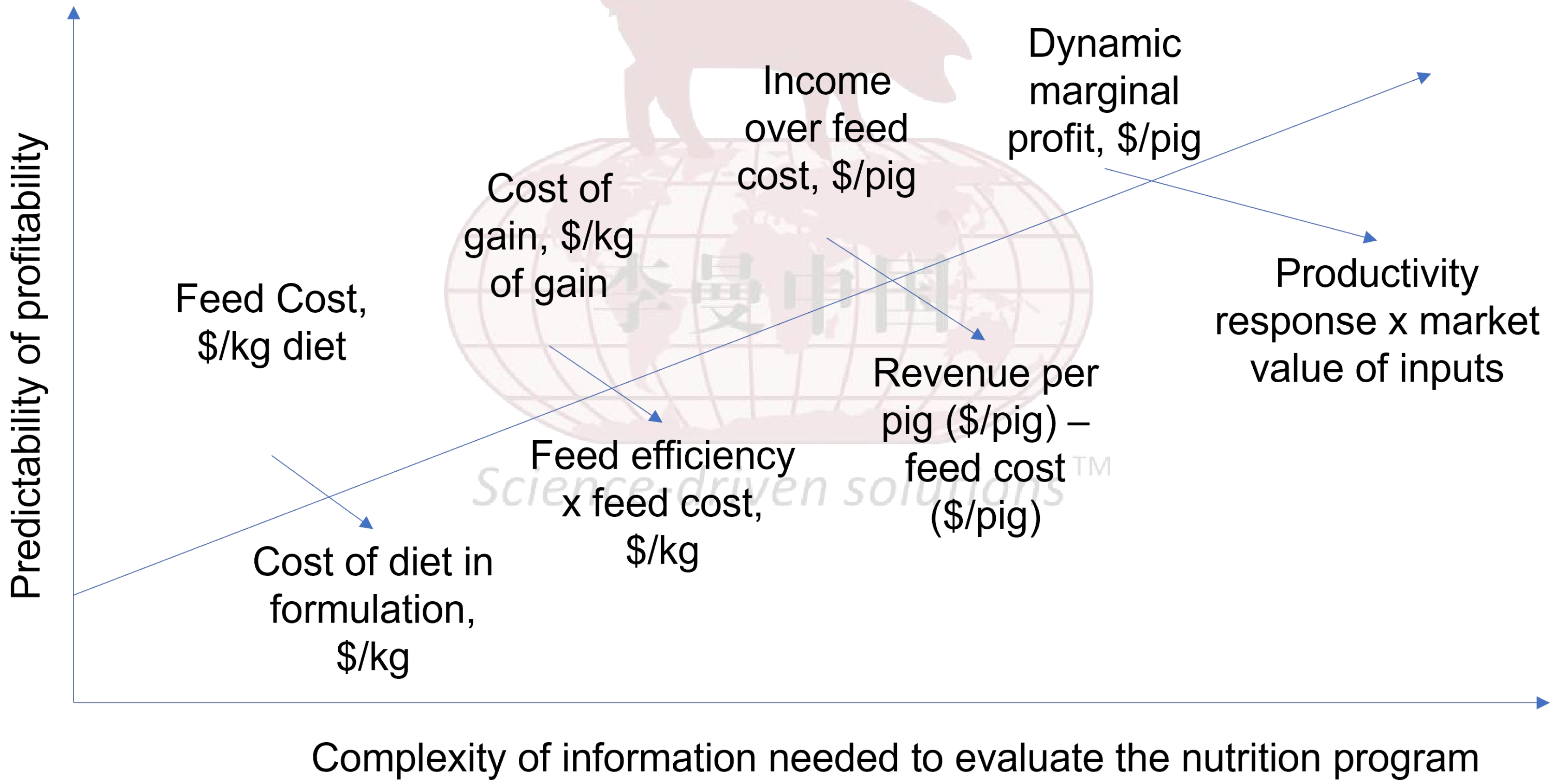
High use of soybean oil for renewable diesel has increased the price of oils and fats

CME, 2022

Economic evaluation of swine feeding programs



Example of economic calculations

Feed cost:

- $ 160/ton or $ 0.08/lb

Cost of gain:

- 2.8 x $0.08/lb = $0.224/lb gain

IOFC: (revenue – feed cost)

- Revenue = HCW x HCW price = 213 lb x $0.70/lb = $149.10
- Feed cost = F/G x ADG x days in finisher x feed cost, $/lb = 2.8 x 1.80 lb/d x 130 d x $0.08/lb = **$ 52.42**
- IOFC = $149.10 – $52.42 = $96.68/pig

Comparison of two feeding programs

Diet A (low energy)

- Diet cost
  - $ 160/ton
- Cost of gain (2.8)
  - $ 0.224/lb gain
- IOFC
  - $ 96.68/pig

Diet B (high energy)

Diet cost

- $ 190/ton

Cost of gain (2.5)

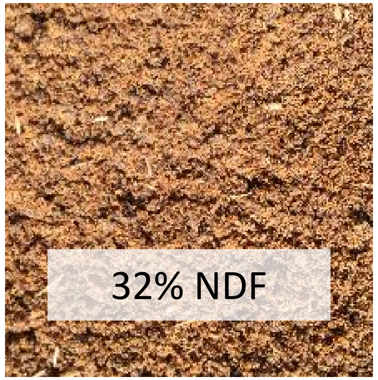
- $ 0.237/lb gain

IOFC

- Revenue = 223 lb x $0.70/lb = $156.10/pig
- Feed cost = 2.5 x 1.90 lb/d x 130 d x $0.095/lb = $58.66/pig
- Income over feed cost = $156.10 – $58.66= **$97.44/pig**

Typical inclusion rates and issues with alternative feed ingredients in swine diets

Ingredient	Inclusion rates, % diet	Comments
Corn distillers dried grains with solubles	10-30%	Variability in composition and mycotoxins
Rapseed & canola meals	10-30%	Glucosinolates, sinapine, and fiber



Challenges of feeding high fiber grain by-products

Problem: Energy content varies among sources

- *Immediate:* work with trusted supplier
- *Long term:* adopt modern dynamic energy valuation models

Fiber reduces crude protein and ether extract digestibility

- *Immediate*: use of updated digestibility values and exogenous enzymes
- *Long term*: increase digestibility by ingredient fermentation

Increase size and weight of the gastrointestinal tract

- *Immediate:* implement market withdrawal strategy
- Long term: discover GI signaling pathways and capture gut health benefits of fiber

Variation in nutrient content

Evaluation of substitute coproducts

Leman China Nutrition Workshop, 2022

Dynamic equations allows to estimate energy more accurately

- ME, kcal/kg = − 261 + (1.05 × DE, kcal/kg) − (7.89 × % CP) + (2.47 × NDF) − (4.99 × % Crude Fat)
- Urriola et al. (2014)

- NE, kcal/kg = - 1,130.5 + (0.27 × GE, kcal/kg) + (23.86 × % Crude Fat) – (10.83 × % NDF)
- R^2 = 0.99 – Wu et al. (2016)

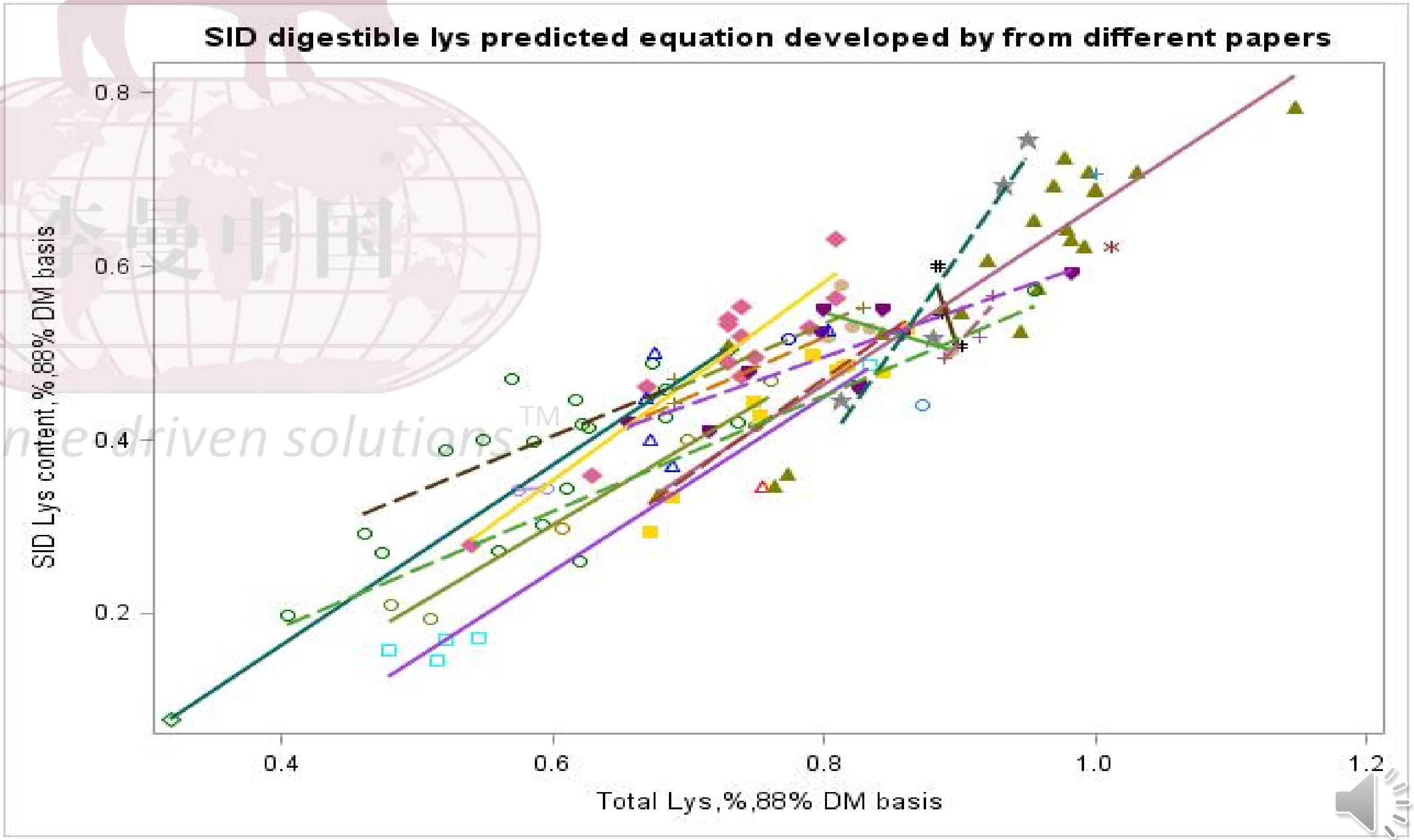
Equations are adequate for high and medium oil DDGS

DDGS	Predicted ME kcal/kg	ADFI kg/d	ADG kg/d	G:F	Carcass traits	Belly IV
HIGH, 14%	**3,297**	2.60	0.93	0.367	No difference	76.4
MED, 10%	**3,277**	2.61	0.92	0.365		72.0
LOW, 6%	**3,250**	2.65	0.92	0.356		70.7

Digestibility of lysine varies among sources of corn DDGS

Zhikai Zeng

SID AA	Studied	Obs	Mean	Max	Min	CV
Lys	23	118	0.476	0.818	0.078	30.3
Met	22	116	0.430	0.678	0.232	18.6



Prediction of the digestible lysine content among sources of corn DDGS

SID Lys, % = -1.03 + (Lys, g/kg × 0.88) – (NDF, g/kg × 0.003)
R^2 = 0.98

SID Met+Cys, % = 0.05 + (Met+Cys, g/kg × 0.92) - (NDF, g/kg × 0.005)
R^2 = 0.99

Zeng et al. (2017)

Making more with less

Evaluation of agricultural resources for optimal upcycle in pigs

Doing MORE with LESS

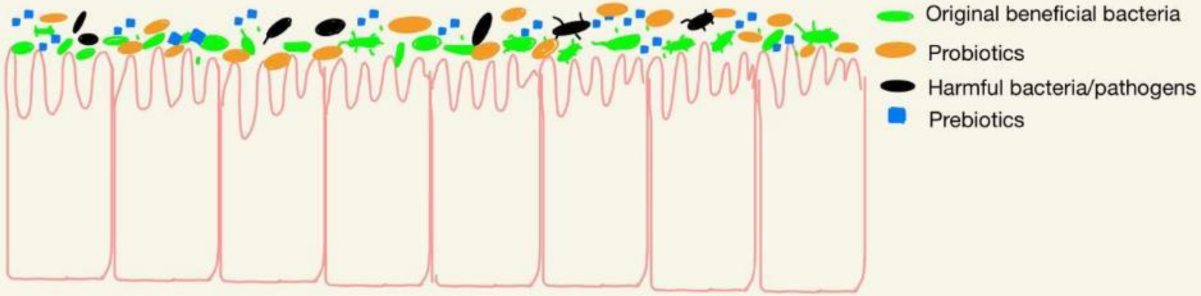
Apparent ileal digestibility of ether extract increases in diets with postbiotic extract

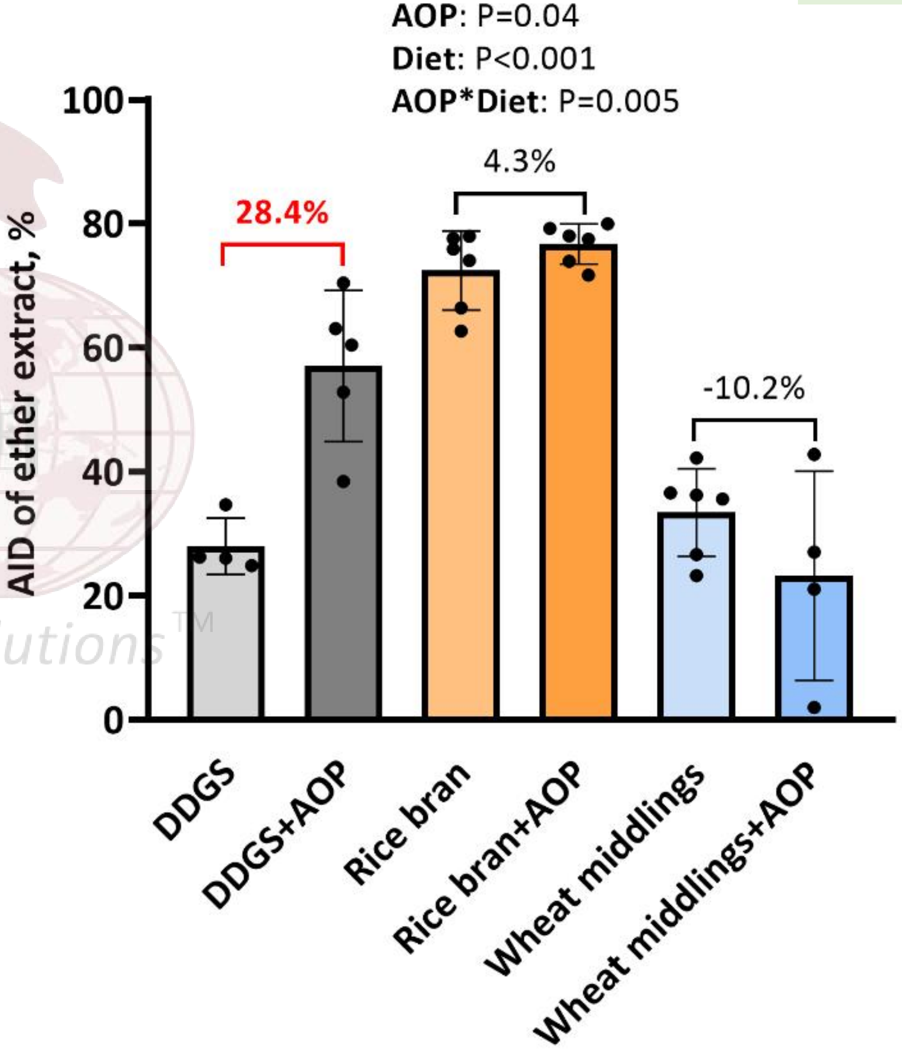
Jinlong Zhu

1. Stimulate bacterial growth
- Lactic acid producing bacteria
- Cellulolytic bacteria
- Lactic acid and short chain fatty acid

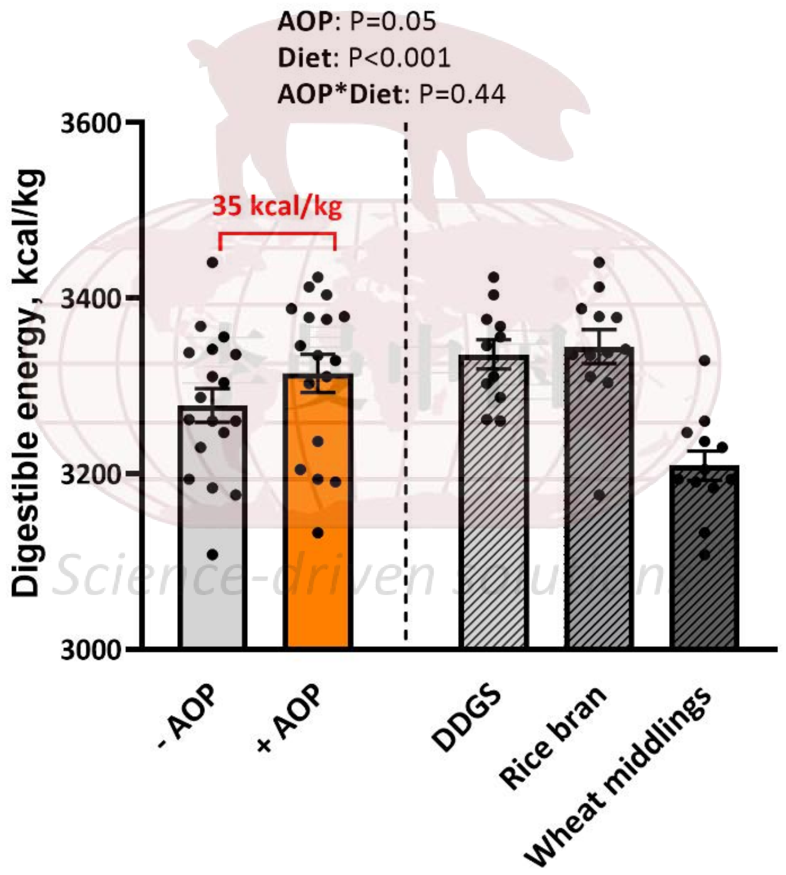
2. Decreased lumen pH
- Inhibit pathogens
- Increase solubility of minerals

3. Enzymatic activity
- Enzyme produced by *Aspergillus oryzae*
- Bacterial enzymes



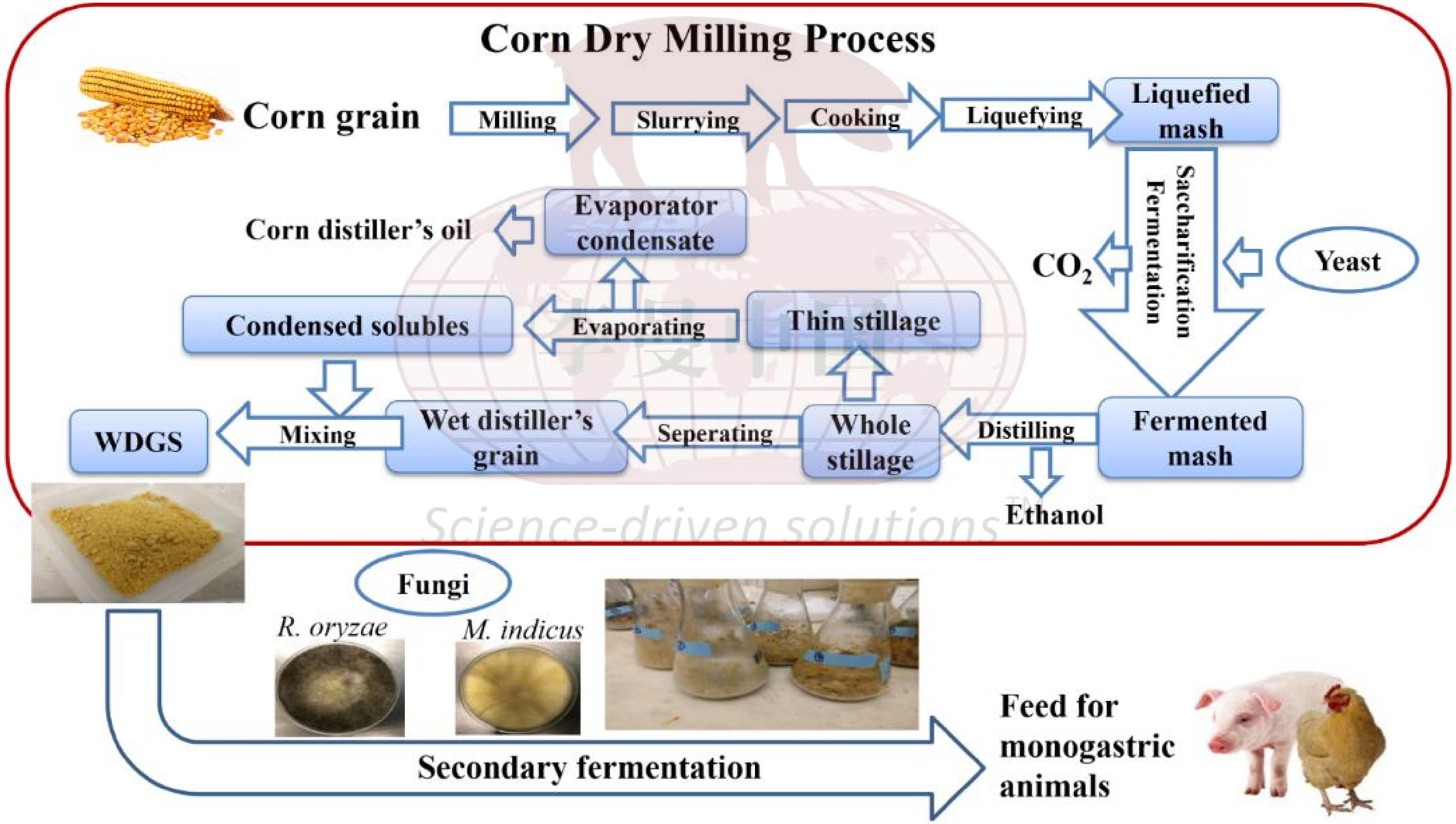


Digestible energy increases with supplementation of *A. oryzae* extract

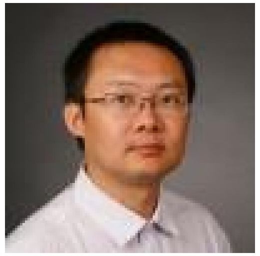


Data are LSmeans ± SEM;
AOP: *Aspergillus oryzae* prebiotic.

Improvement of nutritional quality of high fiber ingredients with fungal fermentation



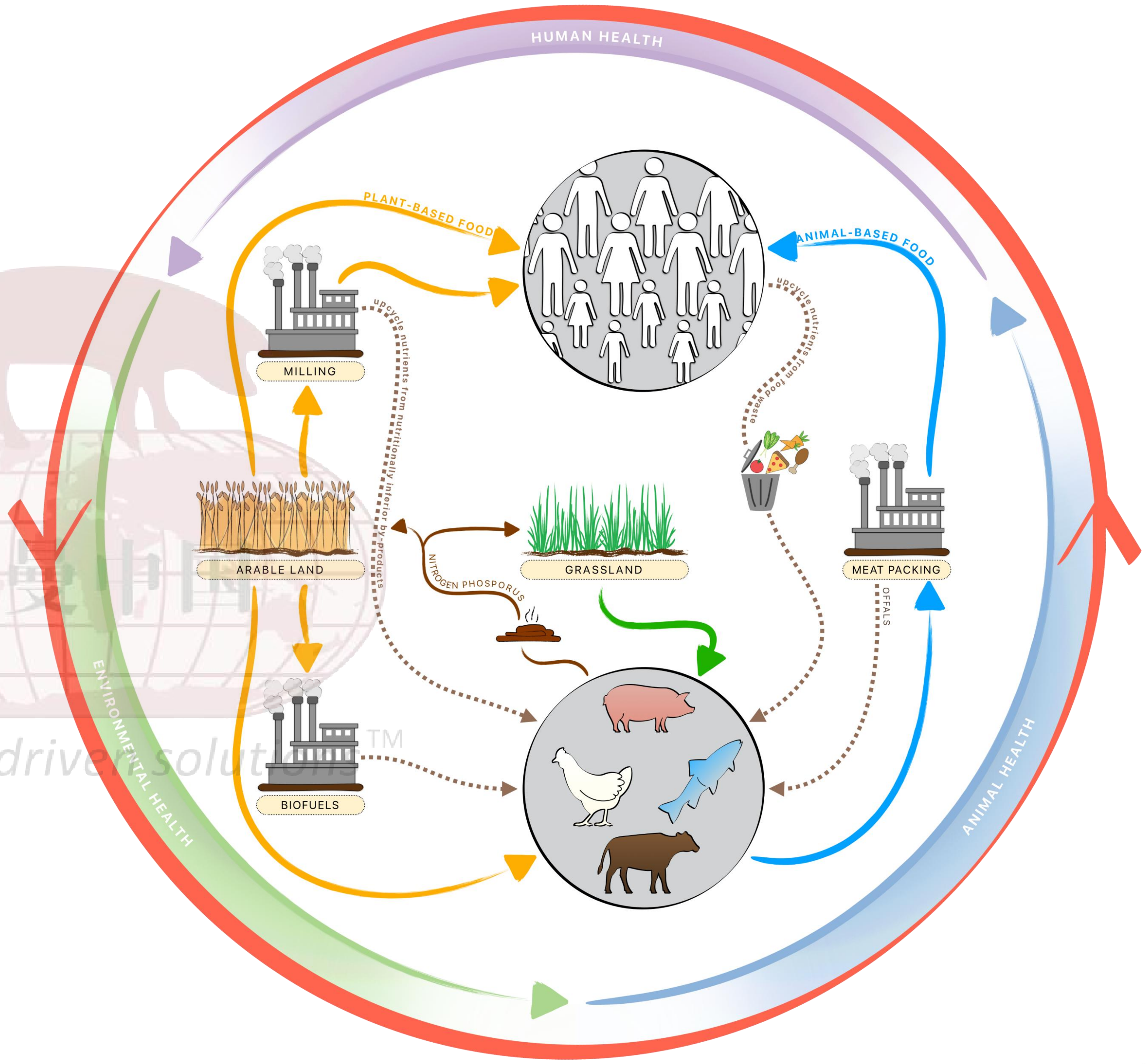
Results highlights



Bo Hu

Substrate	Fermentation outcome
A. oryzae fermentation WDGS	10-37%↑Lys, Arg and Thr concentration 71% ↓ phytate 19-30%↑Lys, Thr and Met digestibility
A. oryzae fermentation WDGS + Soy hulls	24-69%↑Lys, Arg and Thr concentration 54% ↓ phytate 8-12%↑Lys, Thr and Met digestibility
A. oryzae fermentation WDGS + PT-Soy hulls	18-42%↑Lys, Arg and Thr concentration 75% ↓ phytate 9-17%↑Lys and Thr digestibility

Circularity of modern livestock and food production systems (Shurson and Urriola, 2022)



Take home message

Immediate term practices:

Updated ingredient loading values

Increase energy and nutrient digestibility with postbiotics and enzymes

Long term transformation of the feed industry:

Upcycle more raw materials with lower environmental footprint

Transform feed ingredients to enhance their nutritional value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