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Australian Export Grains Innovation Centre

# Using Australian feed grains to increase animal performance and profitability while reducing greenhouse gas emissions

Dr Steve Little, Consultant to AEGIC

Department of Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

AEGIC is an initiative of the Western Australian State Government and Australia's Grains Research and Development Corporation

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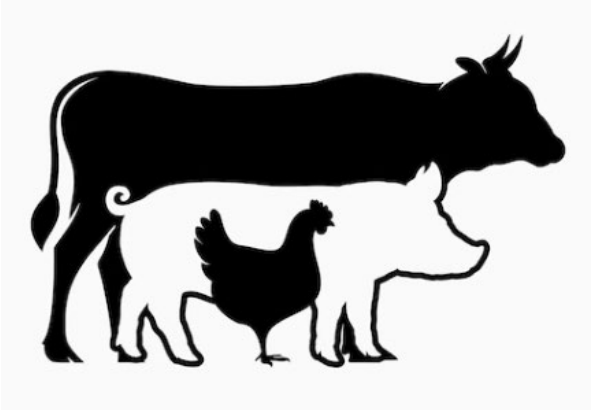
# In this presentation

Asian consumer demand for meat and dairy foods

Opportunities for livestock production in Asia

Strategies using Australian feed grains



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# Asian consumer demand for meat and dairy foods

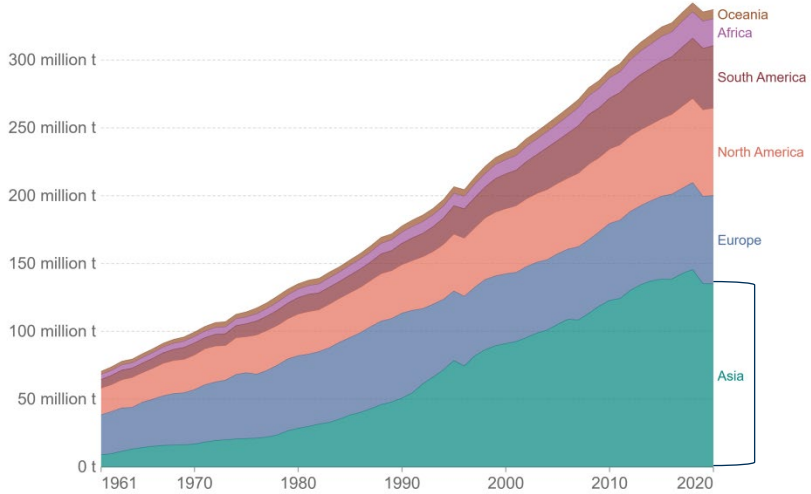
***Looking back over the past 60 years***

The world is hungry for animal protein.

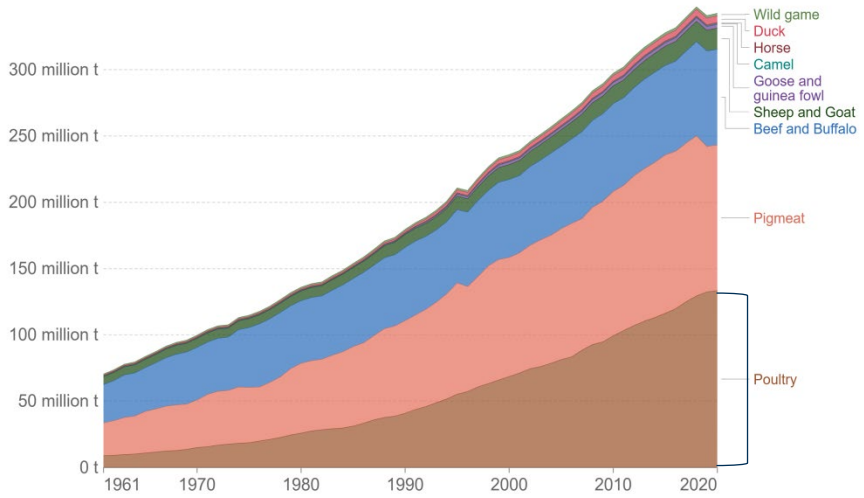
Regionally, Asia is now the biggest meat producer (40-45% of global production).

Meat production has shifted towards poultry (now 39% of global production).

**Global meat production, by region, 1961-2020**




**Global meat production, by type, 1961-2020**



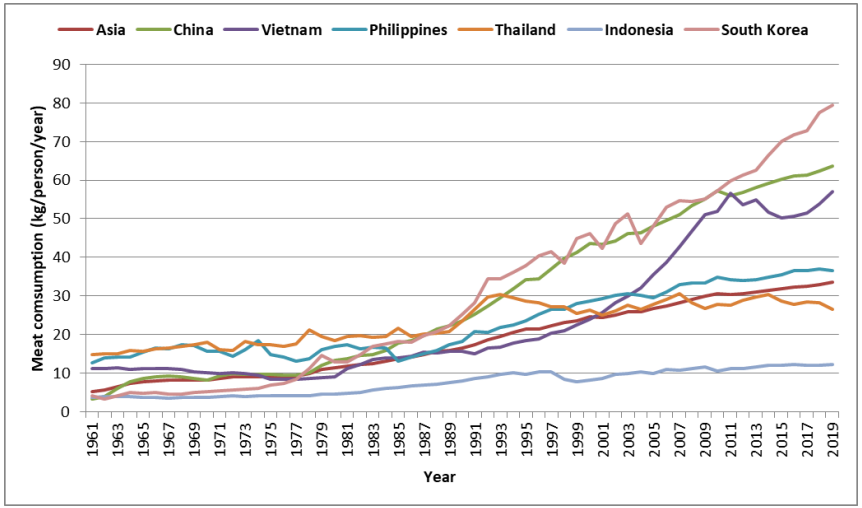

Ritchie et al, 2019

# Asian consumer demand for meat and dairy foods

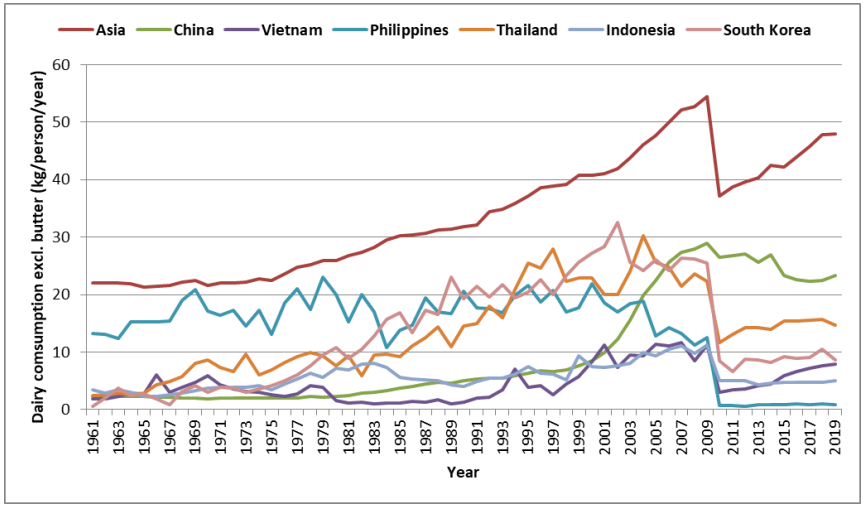
***Looking back over the past 60 years***

Asian consumers' meat and dairy consumptions have steadily increased.

**Meat consumption (kg/person/year)**




**Dairy consumption excl. butter (kg/person/year)**




Ritchie et al, 2019

# Asian consumer demand for meat and dairy foods

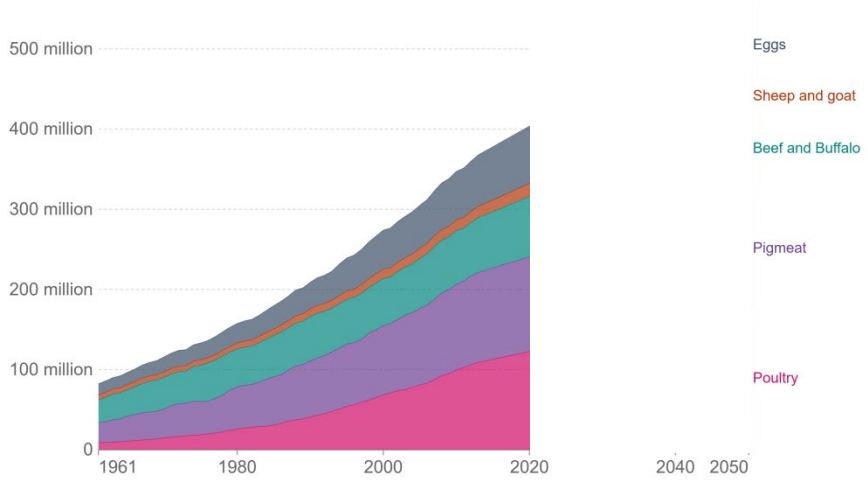
## *Looking forward to 2050*

Demand for meat and dairy foods will continue to increase, driven by:

- population growth;
- household income growth; and
- desire for more animal protein in diets.

This is especially true in Asia due to higher increases in population and meat and dairy food consumption per person from a lower base than most other regions.

**Global meat production, by type, 1961-2050**




Ritchie et al, 2019

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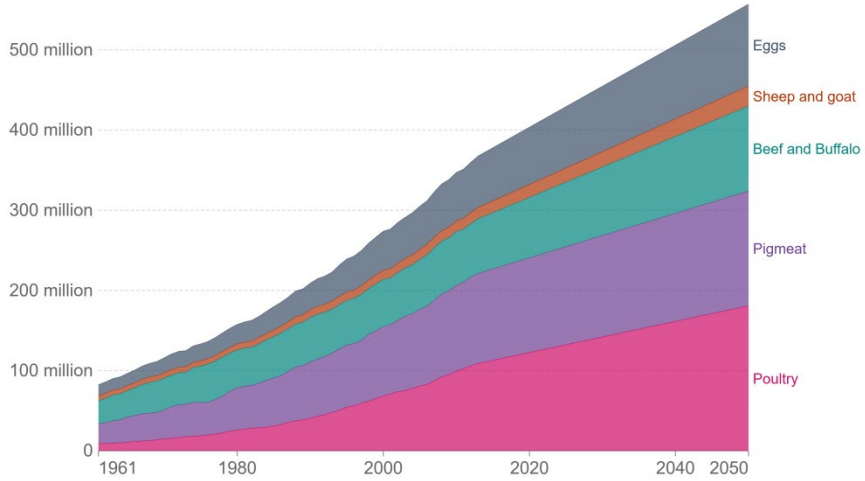


Ritchie et al, 2019

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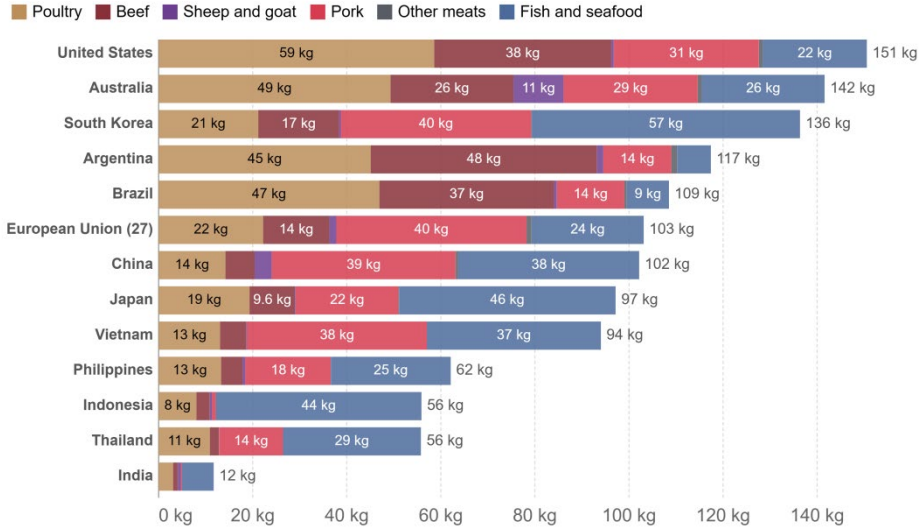
**Meat consumption/person/year, by type, 2019**




Ritchie et al, 2019

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# Asian consumer demand for meat and dairy foods

***Looking forward to 2050***


Agricultural = ~24% of all global GHG emissions.

Many countries committed at COP26 to net zero emissions by 2050.

All have a role to play in sustainable food production – businesses along the food demand chain, government and consumers

Includes socio-environmental costs in cost of production
All along food chain benefit

PROFITABILITY

PLANET
Protects environment and natural resource base

PEOPLE
Socially and culturally acceptable and beneficial

ETHICS
In harmony with food security and animal welfare

COP26

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# Opportunities for livestock production in Asia

Better breeding, feeding and more intensive management lead to:

- ↑ growth rates, more eggs and milk
- ↑ feed conversion efficiency (FCE)
- ↓ greenhouse gas emission intensity

↑ animal performance & profitability


↓ GHG emission intensity

**Better feed conversion efficiency (FCE)**

↓ kg feed per kg gain or g egg mass

↑ kg milk per kg feed

- ☑ Lower production costs
- ☑ Lower greenhouse gas emissions / kg product
- ☑ Lower nitrogen, phosphorus and mineral emissions
- ☑ Lower water consumption
- ☑ Lower energy consumption
- ☑ Less land use changes
- ☑ More biodiversity
- ☑ Less feed-for-food competition

Adapted from Zampiga et al, 2021

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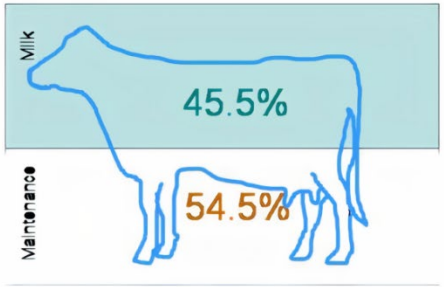
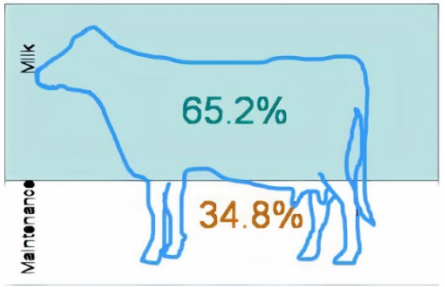
**'Dilution is the solution'**

FCE is improved by reducing proportion of energy required per day for maintenance vs. milk production




5000 kg milk / year




10,000 kg milk / year

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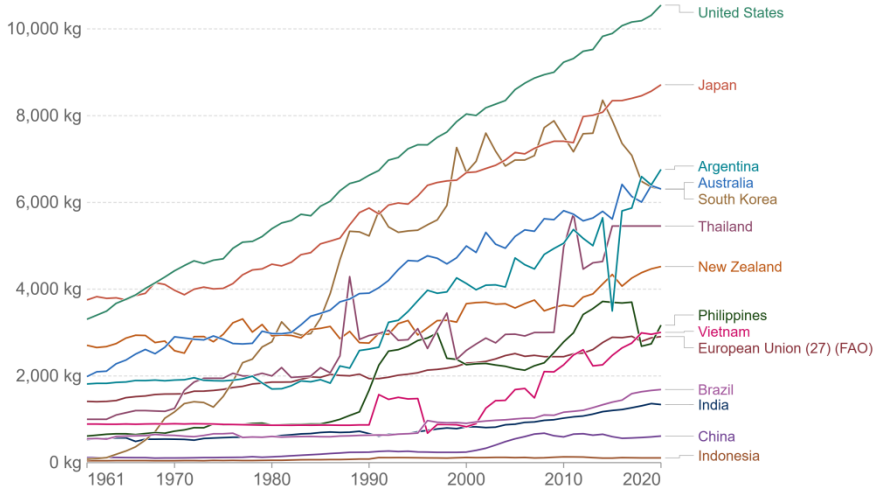
There is great scope for increasing animal productivity and reducing GHG intensity in many Asian countries

**Milk yield/dairy cow, 1961-2020**




Ritchie et al, 2019

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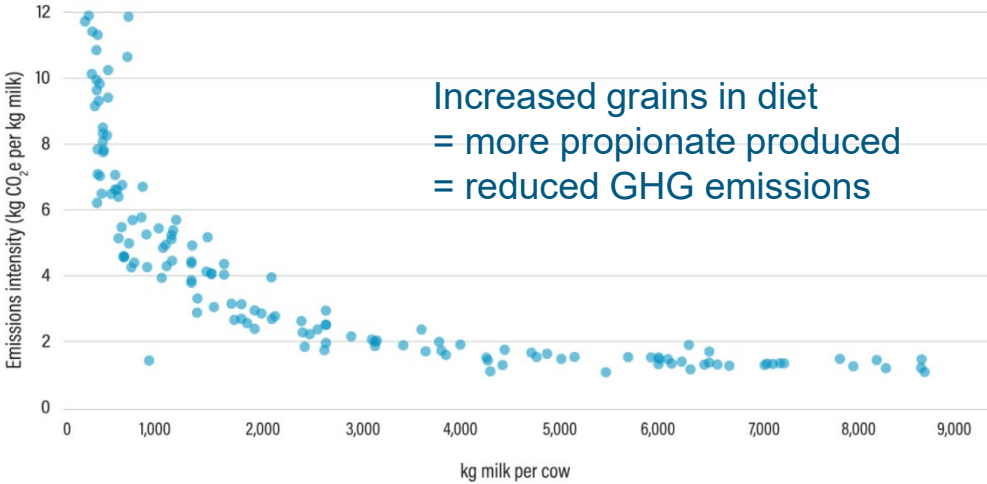
**GHG emission intensity and milk yield/cow/year**




Gerber et al, 2013

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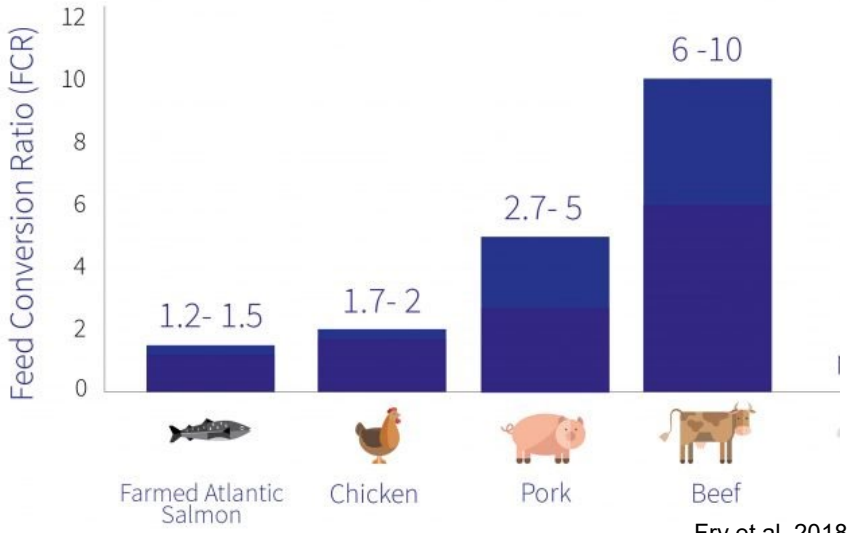
**Feed conversion ratio for selected animals**




Fry et al, 2018

Dairy cow: 1.0 - 1.6 kg milk / kg feed

# Opportunities for livestock production in Asia

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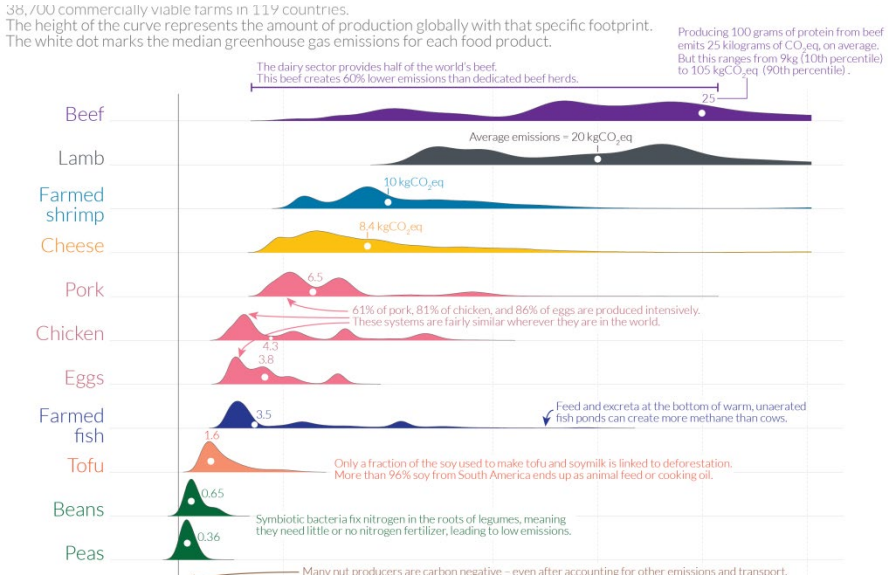
**Greenhouse gas emissions/100 grams protein**




Ritchie et al, 2019

# Strategies using Australian feed grains

Poultry, pigs and cattle are able to utilise a wide range of feedstuffs very effectively

Strategies using Australian feed grains:

1. Replace corn as starch (energy) source in diets when cost-effective.
2. Support gut health and efficiency of pigs and poultry.
3. Support higher milk yields of dairy cattle.
4. Improve fertility of dairy and beef cattle.

# Strategies using Australian feed grains

## Replace corn as starch (energy) source in diet when cost-effective

### Comparative typical proximate analyses

| Specification | | Wheat | Barley | Sorghum | Corn |
|---|---|---|---|---|---|
| Moisture (%) | | 12 | 12 | 13 | 13 |
| Protein (%) | | 11 | 11 | 9.5 | 8 |
| Fat (%) | | 2.3 | 2.6 | 3.5 | 4 |
| Ash (%) | | 1.7 | 2.2 | 2.0 | 1.15 |
| Fibre | Crude (%) | 2 | 4.8 | 2.3 | 2 |
| | NDF (%) | 8.5 | 16.0 | 8.0 | 9 |
| | ADF (%) | 2.5 | 5.5 | 2.5 | 2.2 |
| Starch + Sugar | | 63 | 53.9 | 63 | 64.6 |
| Pig DE* MJ/kg (Kcal/kg) | | 14.0 (3345) | 13.0 (3105) | 14.25 (3404) | 14.5 (3465) |
| Broiler ME* MJ/kg (Kcal/kg) | | 13.45 (3215) | 12.56 (3000) | 11.2 (2677) | 13.21 (3157) |
| Layer ME* MJ/kg (Kcal/kg) | | 13.75 (3285) | 13.0 (3105) | 11.8 (2820) | 13.5 (3227) |
| Ruminant ME^ MJ/kg | | 13.3 | 12.8 | 12.2 | 13.5 |

Note – Typical values only – composition can vary widely with different agronomic conditions

NDF = Neutral Detergent Fibre
ADF = Acid Detergent Fibre
DE = Digestible Energy
ME = Metabolisable Energy

* Source: Premier Atlas (2008)
^ Source: Rumen8 (2021)

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| | NDF (%) | 8.5 | 16.0 | 8.0 | 9 |
| | ADF (%) | 2.5 | 5.5 | 2.5 | 2.2 |
| NSP enzyme added in feed (Poultry) | | Xylanase | β-glucanase + xylanase | Nil | Nil |
| Pigment | | Nil | Nil | Nil | Present |
| Mycotoxin risk | | Low | Low | Low | ? |
| Pelletability (FPQF) | | 8 | 5 | 4 | 5 |

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# Strategies using Australian feed grains

| | Wheat | Barley | Sorghum | Corn |
|---|---|---|---|---|
| **Protein (%)** | **11.7** | **10.5** | **9.2** | **7.6** |
| SID Lys | 0.27 | 0.29 | 0.15 | 0.18 |
| SID Met | 0.16 | 0.14 | 0.13 | 0.14 |
| SID M+C | 0.40 | 0.33 | 0.25 | 0.28 |
| SID Thr | 0.28 | 0.28 | 0.23 | 0.22 |
| SID Iso | 0.35 | 0.30 | 0.28 | 0.22 |
| SID Try | 0.13 | 0.11 | 0.09 | 0.05 |
| SID Arg | 0.52 | 0.45 | 0.27 | 0.32 |
| SID His | 0.24 | 0.19 | 0.15 | 0.19 |
| SID Leu | 0.69 | 0.59 | 0.96 | 0.81 |
| SID Val | 0.44 | 0.41 | 0.34 | 0.31 |
| SID Phe | 0.48 | 0.43 | 0.38 | 0.32 |
| Calcium (%) | 0.04 | 0.05 | 0.01 | 0.01 |
| Phosphorus (%) | 0.26 | 0.28 | 0.24 | 0.22 |
| Phytate P (%) | 0.17 | 0.16 | 0.17 | 0.17 |

Wheat and barley have more protein, lysine, methionine + cysteine, tryptophan, calcium and phosphorus than sorghum and corn

SID = Standardised ideal digestibility

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Source: Evonik AminoDat 5.0

# Strategies using Australian feed grains

## Typical formulation constraints on grains (maximum inclusion rates)

| Diet | Wheat | Barley | Sorghum | Corn |
|---|---|---|---|---|
| Broiler starter | 100% | 0-15% | 0-30% | 100% |
| Broiler grower/finisher | 100% | 0-30% | 0-60% | 100% |
| Layer | 100% | 0-50% | 100% | 100% |
| Pig starter | 100% | 10% | - | 50% |
| Pig weaner | 100% | 20% | 15% | 100% |
| Pig grower | 100% | 100% | 60% | 100% |
| Pig finisher | 100% | 100% | 70% | 100% |
| Lactating sow | 45% | 60% | 40% | 100% |
| Dry sow | 45% | 100% | 60% | 100% |
| Beef feedlot starter* | 50% | 50% | 50% | 50% |
| Beef feedlot finisher* | 60-75% | 60-80% | 60-85% | 60-85% |
| Dairy milker* | 20-35% | 20-35% | 20-35% | 35-40% |

* Maximum safe grain feeding rate (% total diet and kg/day) depends on animal type, grain processing method and ruminal acidosis risk factors

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# Strategies using Australian feed grains

## 2. Support gut health and efficiency of pigs and poultry

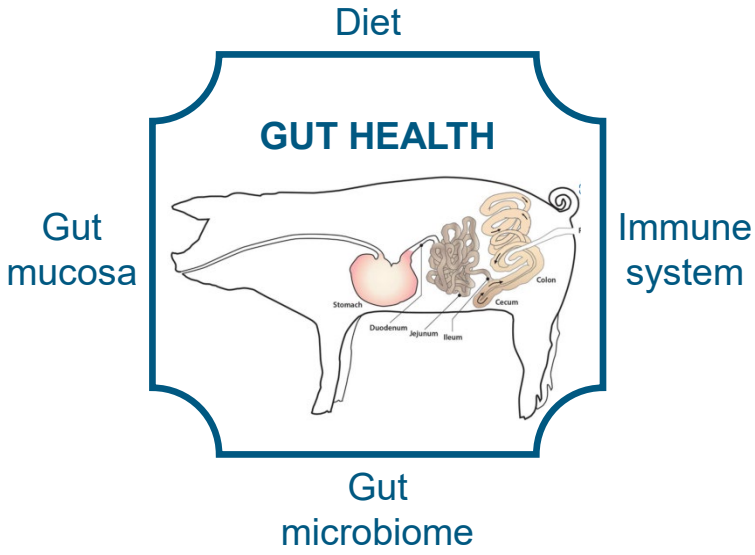
Optimal gut health is essential for high growth rates, FCE and overall health of pigs and poultry.

Selective inclusion of dietary fibre in diets is now an effective alternative to antibiotic growth promoters.

Dietary fibre in diets may provide many benefits:

- Faster maturation of digestive organs
- Improved gut mucosal health and immune function (epithelium, gut-associated lymphoid tissue and mucus) through production of SCFAs (esp. butyrate)
- Enhanced growth of beneficial microbes at the expense of pathogens ('prebiotic effect')

Reduced incidence of diarrhoea
Improved feed intake, growth rate, FCE, overall health

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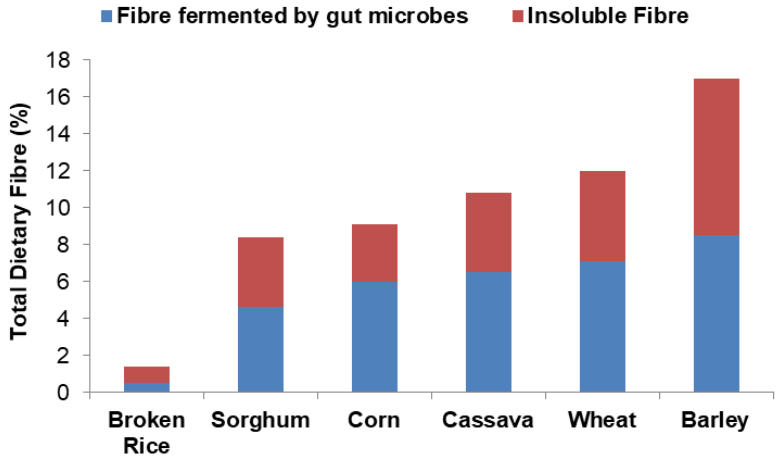
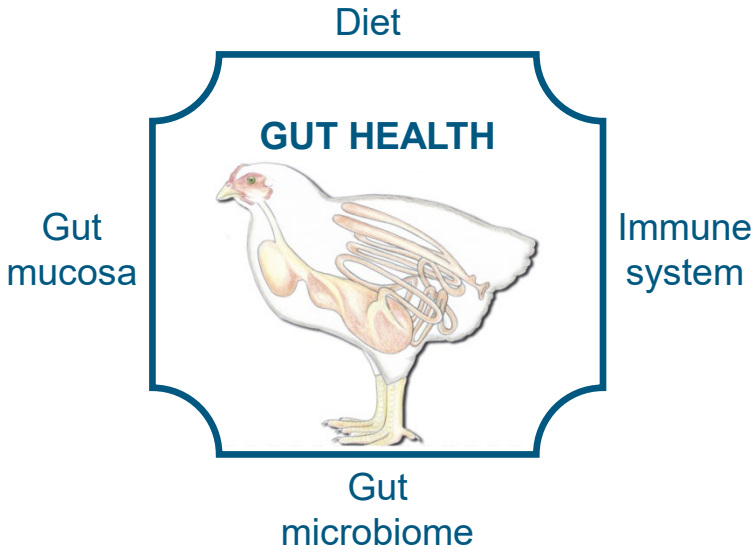
Barley and wheat are starch sources relatively rich in dietary fibre.

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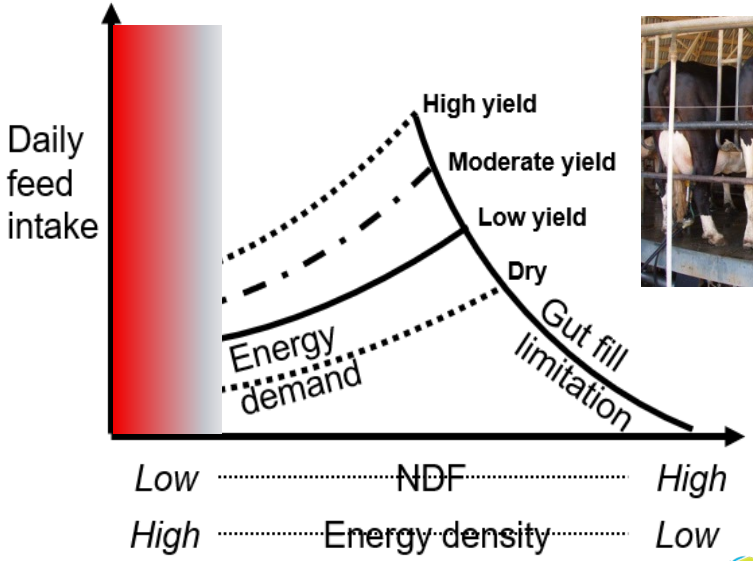
# Strategies using Australian feed grains

## 3. Support higher milk yields of dairy cattle

Feed wheat / barley / sorghum as energy-dense ingredients to help formulate milker diets that support higher feed intake, milk yield and FCE.

**Feed intake regulation in cattle**




Adapted from Mertens, 1997

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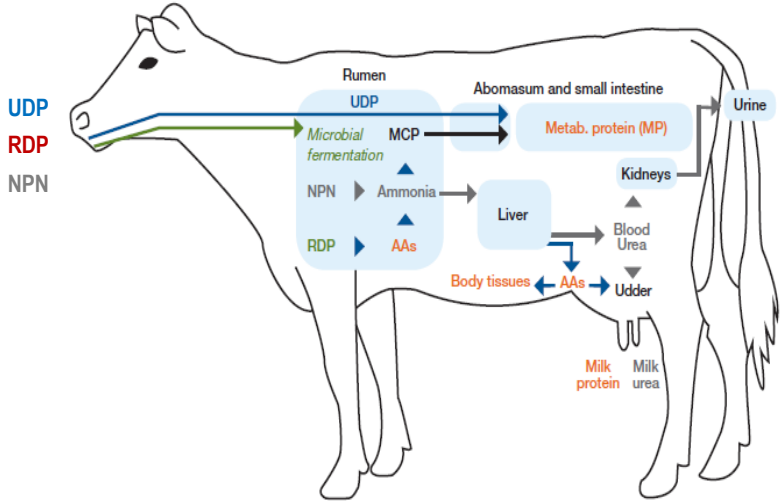
# Strategies using Australian feed grains

## 3. Support higher milk yields of dairy cattle

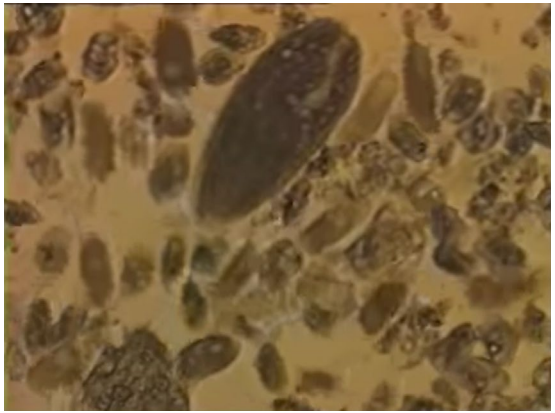
Feed wheat / barley as primary starch source or as complementary starch source with corn to:

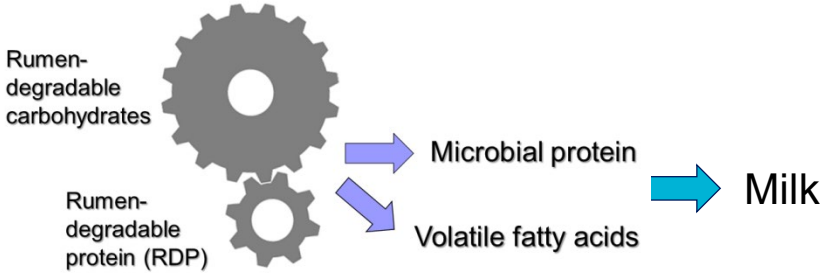
- achieve a better balance of rapidly, moderately and slowly degrading starch sources in rumen;
- increase assimilation of RDP as microbial protein; and
- reduce inputs of costly protein sources.




Dairy Australia, 2016

**Rumen microbes digesting feed particles**





# Strategies using Australian feed grains

## 4. Improve fertility of dairy and beef cattle

Feed wheat / barley to improve cow fertility by:

- calving at body condition score (BCS) 2.5 to 3.0 (on 1 to 5 scale);
- reducing body condition loss in early lactation, and achieving a higher BCS at mating; and
- increasing % starch in post-calving diet to elevate plasma insulin level, thereby reducing days from calving to first oestrus.

*Bos indicus* cows appear to be more difficult to detect in heat than *Bos taurus* cows. If using artificial insemination (AI) or hand-mating, heat detection aids, or heat synchronisation or fixed time insemination programs should be considered.

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# Strategies using Australian canola meal

## Totally or partially replace soybean in diets when cost-effective

**In pigs and poultry**

- Widely used as part-replacement for soybean meal.
- Well balanced amino acid composition.
- Sinapine limits inclusion rate in layer diets .

**In cattle**

- Well balanced source of rumen-undegradable (RDP) and dietary undegradable protein (DUP).
- Helps stimulate microbial protein synthesis in rumen.
- Increases buffering capacity in rumen.
- Stimulates feed intake.
- Most studies (42/49) found that canola meal can replace soybean meal in dairy cow diets with positive milk responses (Huhtanen et al., 2011, Martineau et al., 2013).
- Also useful in calf diets and transition cow diets.

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# Key messages

Demand for meat and dairy food will continue to increase, especially in Asia.

Livestock production businesses are now expected to do more than just be profitable. (Profitability - Planet – People – Ethics).

In Asia there is great scope to increase animal performance and profitability while reducing greenhouse gas intensity (WIN – WIN).

Australian feed grains can serve not just as a replacement for corn in diets. They may also support gut health and efficiency, milk yields and fertility.

With a flexible mindset and an understanding of how to integrate Australian feed grains into diets, you can take advantage of opportunities as they arise.

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# Thank You

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