mFeed+

BOOSTER OF ENZYMATIC ACTIVITY

IMPROVED USE OF INGESTED NUTRIENTS

Local regulations should be consulted concerning the status of this product in the country of destination.
All information only for export outside Europe.

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SEEKING PERFORMANCE

- Meat, eggs and milk producers' margin is considerably dependant upon feed efficency.
- **Investing in feed efficiency improvement** compensates for the additional cost of raw materials.
- **The more expensive the feed, the more important to invest in feed efficiency!**

FEED COST DECREASE WITH FCR IMPROVEMENT	Low price	High price
Standard broiler feed price ($/T)	350	450
Standard feed cost with FCR = 1.8 ($/T of produced liveweight)	630	810
Improvement of 2% in FCR		
Feed cost ($/T of produced liveweight)	617.40	793.80
Net gain ($/T of produced liveweight)	**12.60**	**16.20**
Improvement of 4% in FCR		
Feed cost ($/T of produced liveweight)	604.80	777.60
Net gain ($/T of produced liveweight)	**25.20**	**32.40**

mFeed+

DIGESTION

FROM FEED TO GROWTH

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DIGESTION PROCESS

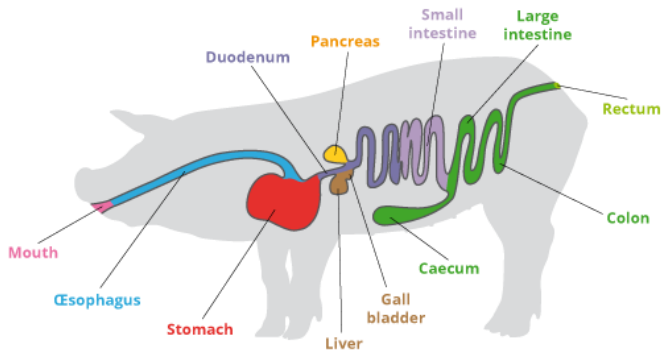
THE WAY TO GROWTH AND PRODUCTION

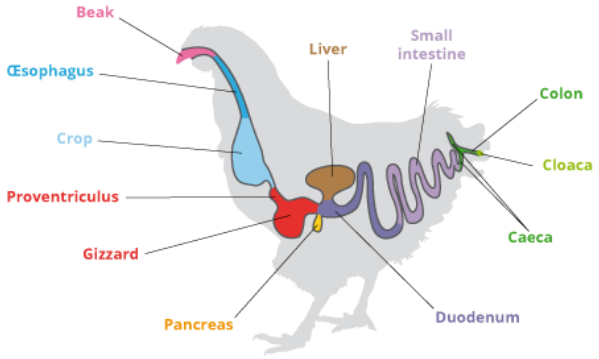
- Occuring from mouth and beak to the large intestine, **digestion is transforming feed into nutrients**.
- Nutrients are then **absorbed through the intestinal epithelium**, mainly in the small intestine and **distributed to organs** and **used for growth and production**.

DIGESTION PROCESS

ENZYMES AT WORK!

- The main part of the digestion occurs through **enzymatic hydrolysis**.
- The enzymatic hydrolysis is mainly occuring in the **small intestine** (essentially in the duodenum).
- **Several families of enzymes** metabolize:
  - Carbohydrates > sugars
  - Lipids > fatty acids
  - Proteins > peptides
- The **efficacy of enzymes** in the small intestine determines the **success of digestion**.

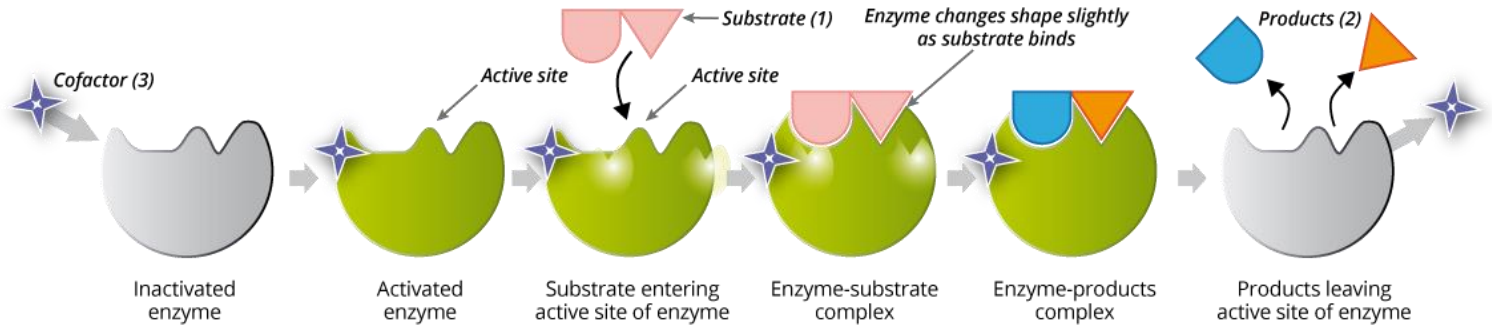




DIGESTION PROCESS

IMPORTANCE OF ENZYMATIC ACTIVITY

- Enzymatic activity is **necessary to hydrolyze feed** into nutrients.
- Nutrients are necessary for the proper functioning of the organs and for **growth and production**.



Principle of enzymatic hydrolysis

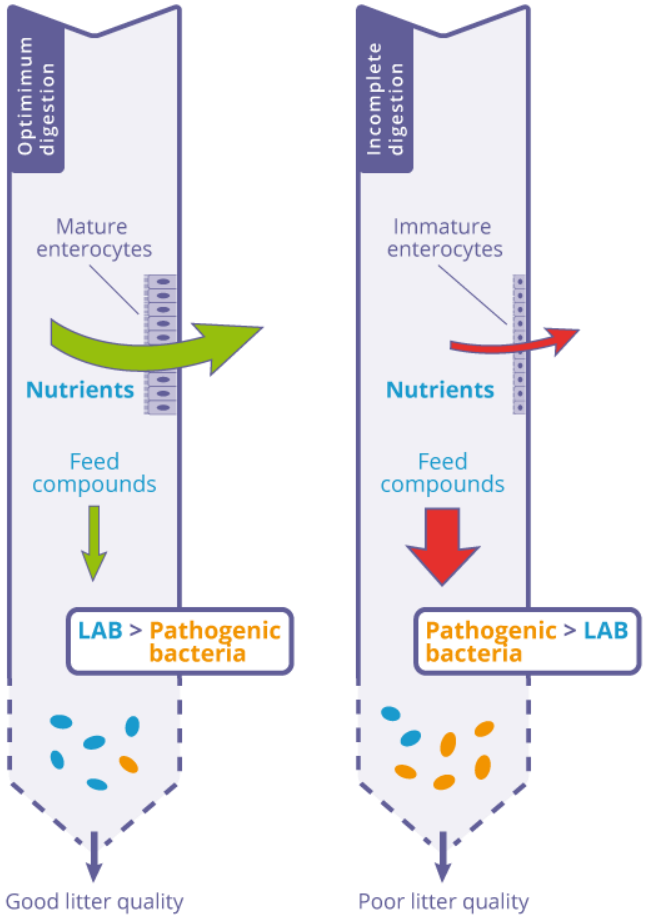
Feed compounds (1) are hydrolyzed into nutrients (2) by the activity of an enzyme, which is active under specific conditions (temperature, pH, presence of a cofactor (3).

DIGESTION PROCESS

IMPORTANCE OF ENZYMATIC ACTIVITY

- A reduction of the **activity of enzymes in the small intestine** leads to an incomplete digestion of the feed, and so a poorer feed efficiency.

- It also causes an **imbalance of the intestinal microflora** and favors the **development of pathogenic bacteria** causing digestive troubles to the animal.



mFeed+

INCREASING FEED EFFICIENCY
BY OPTIMIZING ENZYMATIC ACTIVITY

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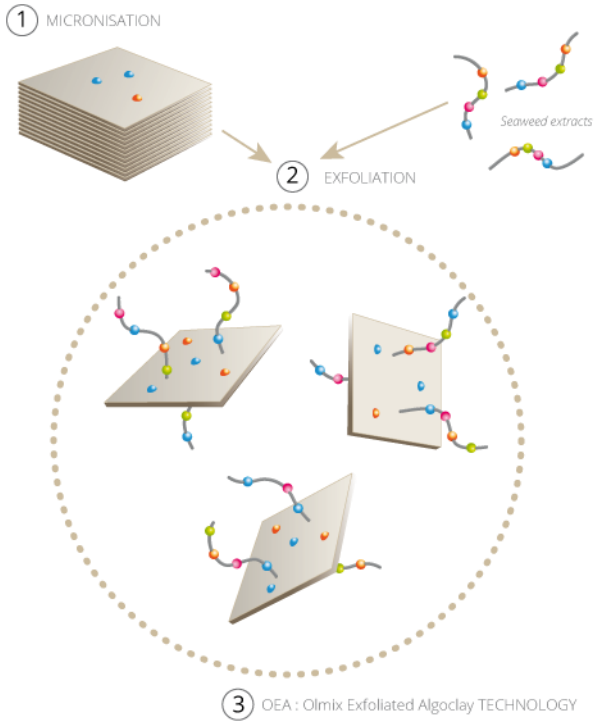
OLMIX EXFOLIATED ALGOCLAY
PATENTED TECHNOLOGY

OEA®

- MFeed+ is based on the **patented technology OEA**: Olmix Exfoliated Algoclay.

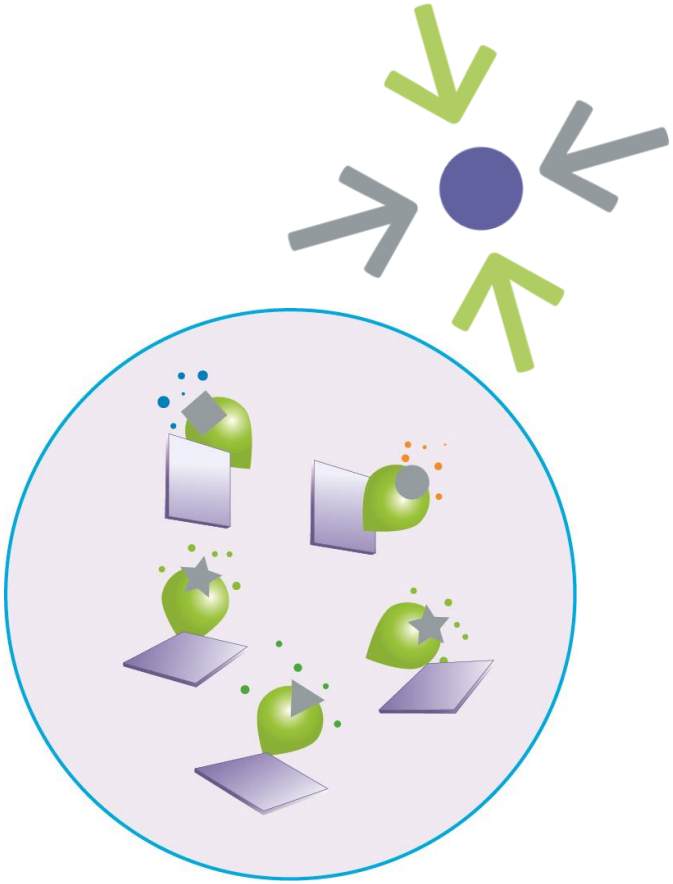


- OEA is composed of a **micronized Montmorillonite which is exfoliated with specific algae extracts** (from *Ulva sp.* and *Solieria chordalis*).
- OEA is a biocatalyst, by :
  - Favoring contact between substrate and enzymes,
  - Improving enzymes activity with cofactors (metallic ions).

OLMIX EXFOLIATED ALGOCLAY

FAVORING ENZYME – SUBSTRATE CONTACT

- **Enzymes need to be in contact with their substrate** for hydrolysis to occur.
- Exfoliated layers offer a **very large contact surface** (up to 800 m^2/g), with which enzymes can interact.
- This makes a real "**meeting point**" between enzymes and their substrate and provides a **reaction support for the enzymatic hydrolysis**.

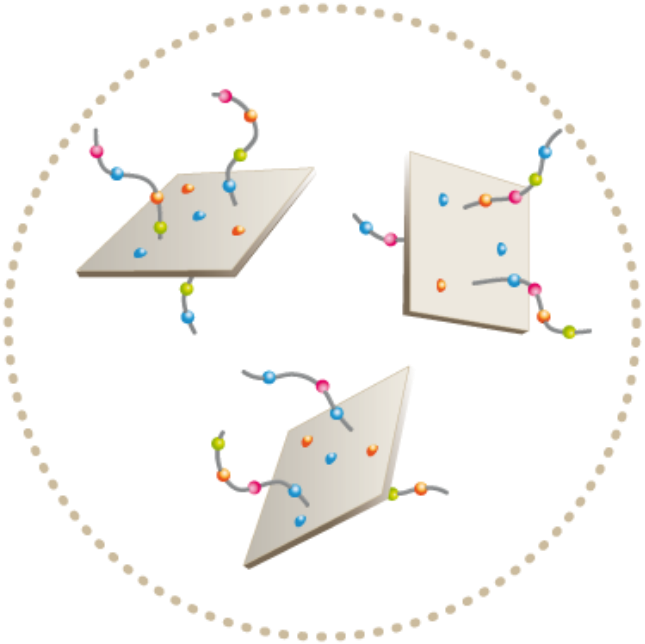


Cabezas et al., 1991; Habold et al., 2009; Parsini et al., 1999; Reichardt, 2008; Xia et al., 2004

OLMIX EXFOLIATED ALGOCLAY

ACTIVATING ENZYMES WITH COFACTORS

- Clay exfoliation makes metallic ions present in the clay (cofactors) very accessible to enzymes.
- Seaweeds are a unique source of metallic ions: they bring **more than 20 different metallic ions**: Fe, Cu, Zn, Ti, Mn, Mo, Pd, W, V, Co, Ni, Pt, Au, Ag, ...



Jondreville et al., 2002; Niederhoffer, 2000; Williams, 1960

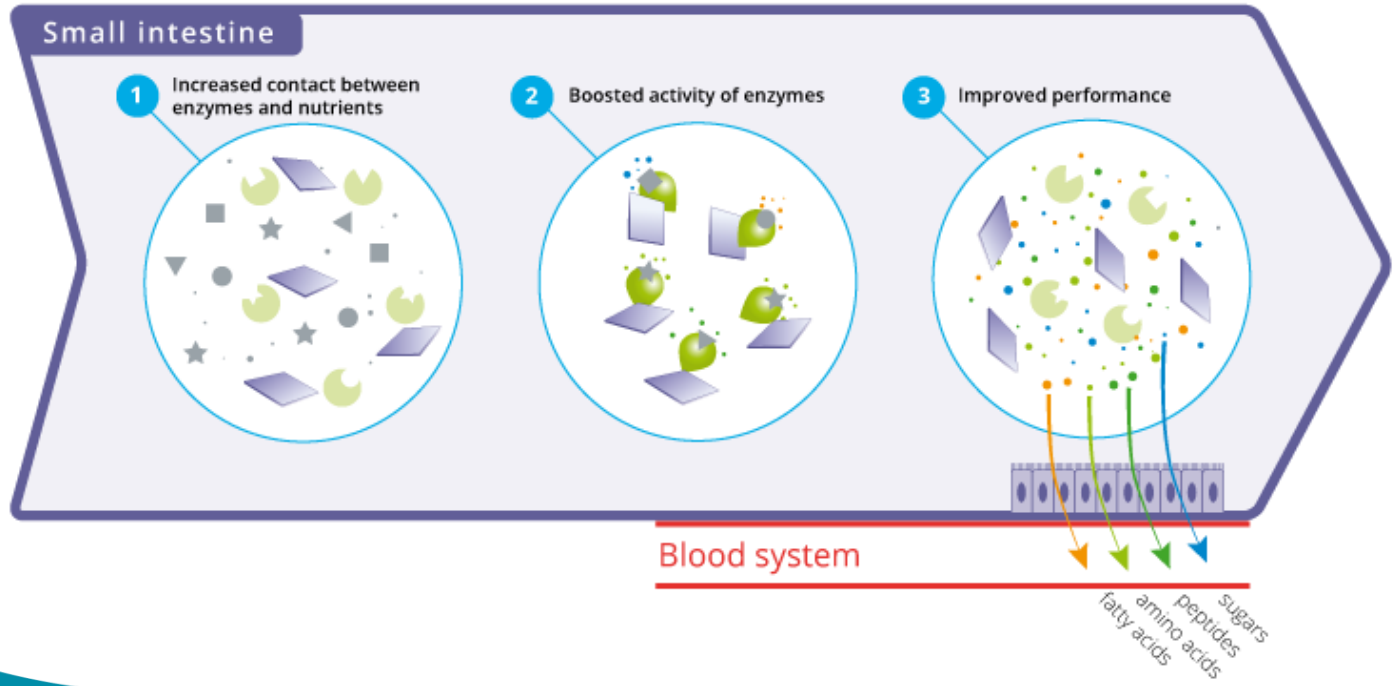
OLMIX EXFOLIATED ALGOCLAY

3-STEP PROCESS

1- **Increased contact** between enzymes and substrate

2- **Increased activity and stability** of enzymes

3- **Better digestion and more nutrients for absorption**



PERFORMANCE ORIENTED SOLUTION

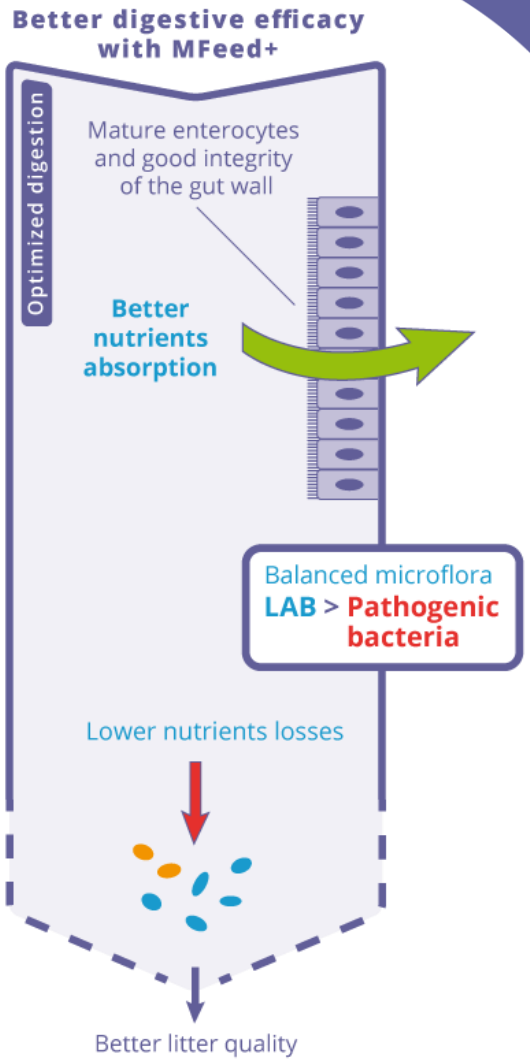
MFeed+

More digested nutrients

More nutrients
used for growth

Less undigested feed
in the large intestine

Balanced microflora
and preserved gut wall



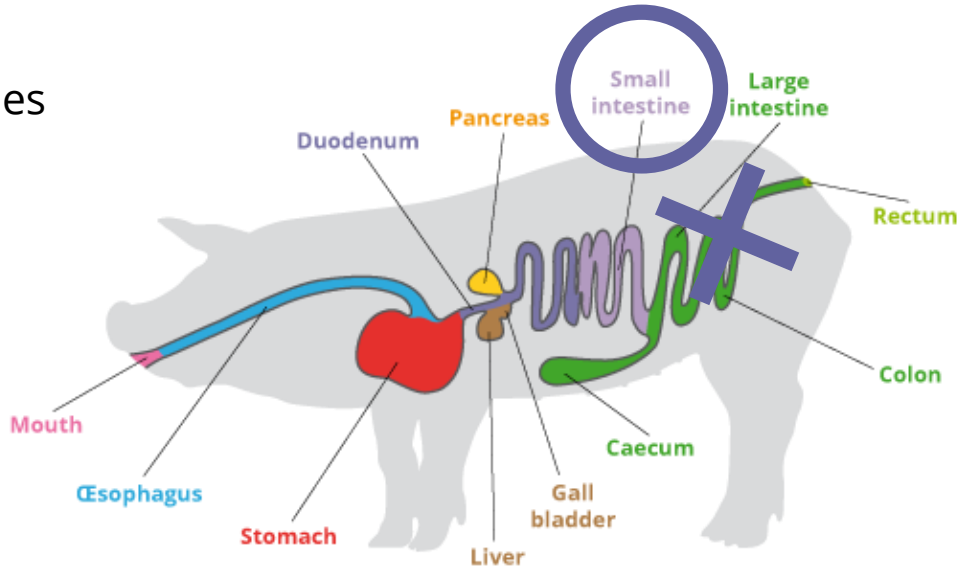
EFFECT OF MFEED+ ON ILEAL DIGESTIBILITY

SCIENTIFIC STUDY, INRA, FRANCE – 2015

Evaluating the capacity of MFeed+ to increase the **ileal digestibility of nutrients**

Conducted at INRA Saint-Gilles

INRA SCIENCE & IMPACT



EFFECT OF MFEED+ ON ILEAL DIGESTIBILITY

SCIENTIFIC STUDY, INRA, FRANCE – 2015

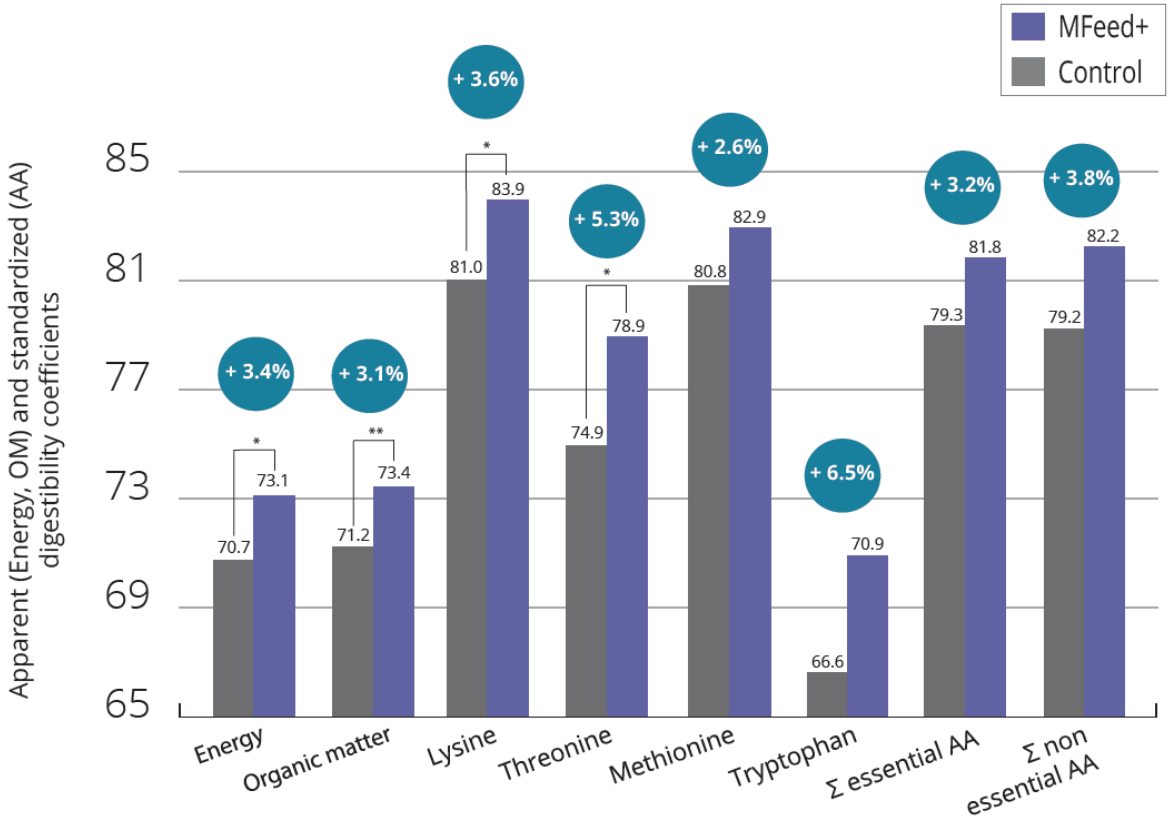
MATERIALS & METHOD

- Ileorectal anastomosis of 5 pigs (≈ 30kg)
- Trial diets:
  - **Control**: standard diet
  - **MFeed+**: standard diet + 0.1% MFeed+
  - LP-LE: low protein and low energy diet (to estimate endogenous losses)
- Calculation of **digestive utilization coefficients** (CUD):
  - In ileum (CUDi) for: DM, OM, N, CF, NDF/ADF, GE and aa
  - Standardized (CUDs) for: proteins and aa, taking into account endogenous losses

EFFECT OF MFEED+ ON ILEAL DIGESTIBILITY

SCIENTIFIC STUDY, INRA, FRANCE – 2015

RESULTS



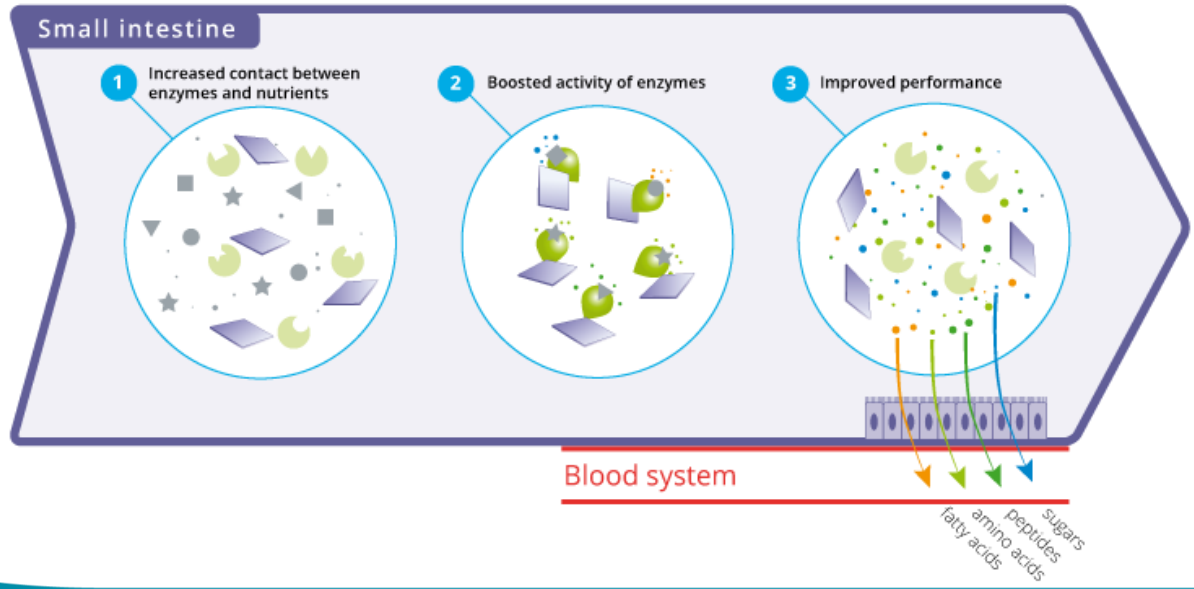
***P ≤ 0.01; *P ≤ 0.05*

EFFECT OF MFEED+ ON ILEAL DIGESTIBILITY

SCIENTIFIC STUDY, INRA, FRANCE – 2015

CONCLUSIONS

- **MFeed+ increases the ileal digestibility of energy (+105 kcal!)**, resulting in an increased absorption of nutrients at the small intestinal level.
- MFeed+ also improves the ileal utilization of some amino acids, including **essential amino acids like lysine and threonine**.



EFFICACY OF MFEED+ IN FATTENING PIGS

FIELD TRIAL, VIETNAM - 2016

- The trial was implemented in North Vietnam, from June to August 2016.
- 204 pigs (90 days old) were randomly distributed to 2 groups, with 3 replicates/group:
  - **Control group:** standard grow-finish ration
  - **MFeed+ group:** grow-finish ration supplemented with MFeed+ (0.1% from week 1 to 7 and 0.05% from week 8 to 10)
- Measurements:
  - Feed consumption
  - Mortality and culling
  - Disease occurrence

EFFICACY OF MFEED+ IN FATTENING PIGS

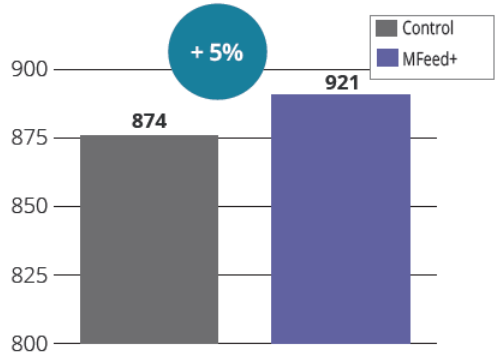
FIELD TRIAL, VIETNAM - 2016

Results

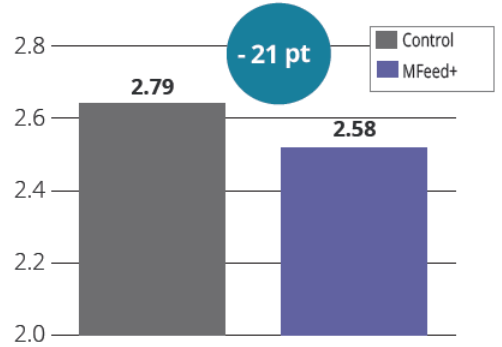
Performance

Parameters	Control	mFeed+	Variation
Pigs at start, n	102	102	/
Initial weight (≈ 90 d), kg	37.4	37.1	- 0.3
Final weight (≈ 160 d), kg	96.6	97.2	+ 0.6
Average Daily Gain, g/d	874	921	**+ 5%**
Total Feed Intake, kg	14,675	14,811	**+ 1%**
Average feeding duration, d	68	66	- 2
Feed Conversion Ratio	2.79	2.58	- 0.21
Mortality, n	2	1	/

→ **Average daily gain, g/d**



→ **Feed Conversion Ratio**



EFFICACY OF MFEED+ IN FATTENING PIGS

FIELD TRIAL, VIETNAM - 2016

Economic analysis *(under local conditions at the time of trial*)*

	Control	MFeed+	Variation
Number of pigs sold	100	101	+ 1
Feed intake-stage 1, kg Feed intake-stage 2, kg	10,140 4,535	10,581 4,230	+ 441 - 305
Feed cost, VND/group	149,685,000	151,072,200	+ 1,387,200
MFeed+ investment, VND	0	1,508,285	+ 1,508,285
TOTAL FEED COST, VND	149,685,000	152,580,497	+ 2,895,497
Average final weight, kg	96.6	97.2	+ 0.6
Total live weight sold, kg	9,656	9,820	+ 164
INCOME, VND	473,122,276	481,178,048	+ 8,055,773
Benefit over feed cost, VND	323,437,276	328,597,551	+ 5,160,275
Benefit over cost, USD	14,702	14,936	+ 235
		ROI	3:1

**Feed price: 10,200 VND/kg Pig price: 49,000 VND/kg live weight 1 USD = 22,000 VND*

EFFICACY OF MFEED+ IN FATTENING PIGS

FIELD TRIAL, VIETNAM - 2016

MFeed+ unique technology improves the activity of enzymes and efficiency of the feed. It improves growth performance (heavier pigs, shorter breeding time!) with great cost effectiveness: **ROI = 3:1**.

EFFICACY OF MFEED+ IN BROILERS

SCIENTIFIC TRIAL, USA - 2015

Protocol:

- 352 male broilers randomly allotted to 2 treatments (Control and MFeed+), with 8 pens of 22 chicks per treatment
- Regular company feeding program:
  - Day 0 – 14: Home fresh starter diet
  - Day 15 – 46 : Grind and mix program
- Diets were corn-soy based and also contained cereals by-products:
  - 9% wheat middling, 3% corn gluten meal and 2% corn DDGS in starter feed
  - 9% corn DDGS in grow-to-finish feed.
- Both feeds contained several digestibility enhancers, including a protected butyric acid, and different enzymes (phytase, xylanase, protease and amylase). The starter feed also contained a coccidiostat.
- MFeed+ supplementation: 0.2% in starter, 0.1% in grower-finisher.

EFFICACY OF MFEED+ IN BROILERS

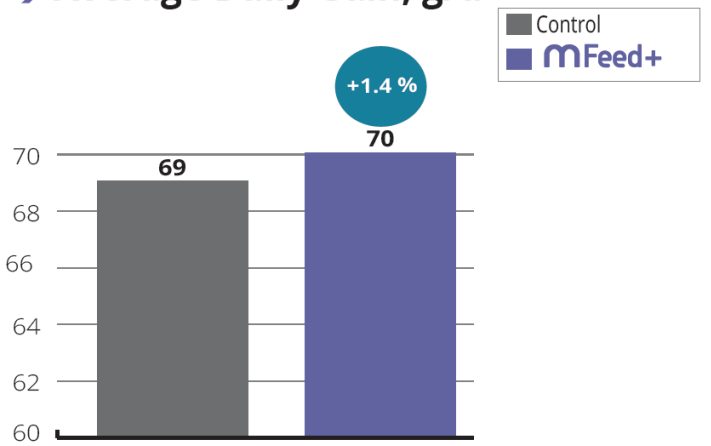
SCIENTIFIC TRIAL, USA - 2015

Zootechnical performance

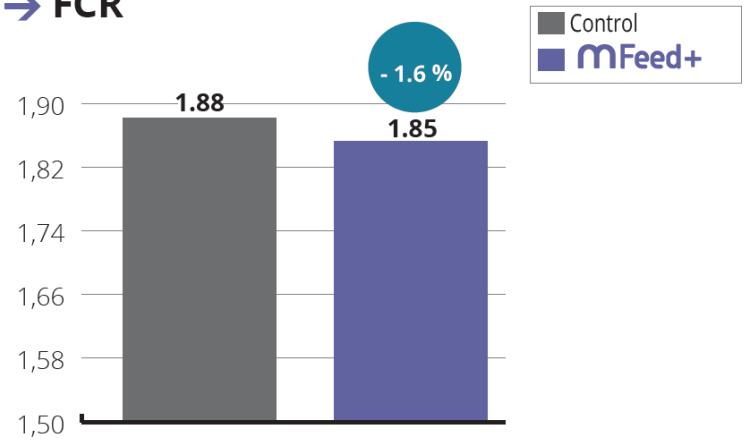
Parameter	Stage	Control	MFeed+
Average Daily Gain, g/d	Starter Grower-finisher	20.0 90.4	20.3 91.7
Global ADG, g/d		69	70
Average Feed Intake, g/d	Starter Grower-finisher	25.9 174.6	26.8 173.9
Global FI, g/d		129.4	129.1
Feed Conversion Ratio	Starter Grower-finisher	1.296 1.933	1.319 1.898
Global FCR		1.88	1.85

- Growth rate was increased by 1.4% and feed efficiency was improved by 1.6% in MFeed+ group.

→ Average Daily Gain, g/d



→ FCR



EFFICACY OF MFEED+ IN BROILERS

SCIENTIFIC TRIAL, USA - 2015

Economic performance

Parameter	Control	MFeed+	Difference
Final weight of chickens, kg	3.219	3.262	+0.043
Sold weight, kg	566.46	574.15	+7.69
Income, €	832.70	844.01	**+11.31**
Feed cost, €	359.76	363.35	**+3.59**
MFeed+ investment, €	0	4.03	+4.03
Net benefit, €	472.94	480.66	**+7.72**

- Net benefit is increased by 0.044€ per broiler
- Return on investment = 2:1

EFFICACY OF MFEED+ IN BROILERS

SCIENTIFIC TRIAL, USA - 2015

- CONCLUSIONS

Despite the high supplementation in digestibility enhancers, MFeed+ proved to be very efficient in optimizing enzymes activity in the small intestine to make the most of the feed.

*It is both technically and economically interesting: every **$1 invested in MFeed+ has a net return of $2!***

EFFICACY OF MFEED+ IN GIBEL CARP

SCIENTIFIC TRIAL, CHINA - 2017

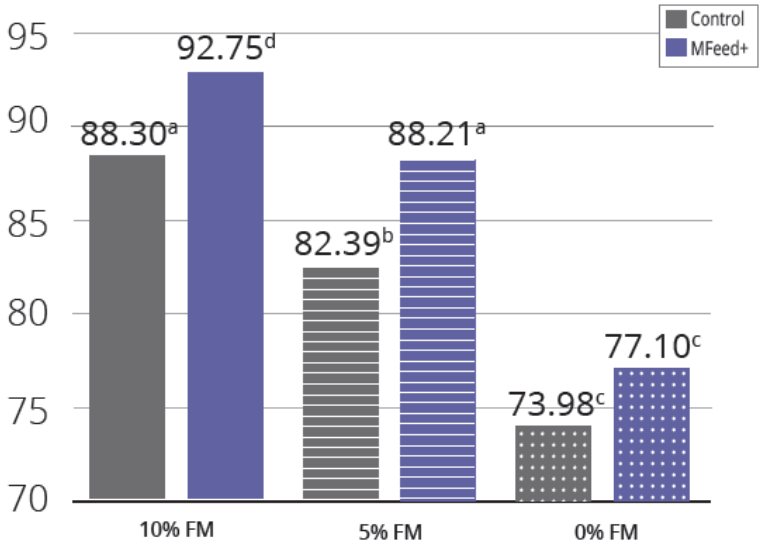
- Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences.
- 480 mixed sex carp of 38g, distributed in 24 cages of $1m^{3.}$
- 15-day acclimation period, followed by 56-day experimental period where different levels of fish meal were tested.
- All diets were iso-caloric (17.5 MJ DE/kg) and iso-nitrogenous (33% CP). Fish meal was replaced by plant based products (soybean, cottonseed and wheat meal).

	10% FM commercial diet	5% FM commercial diet	FM free commercial diet
Control (0% MFeed+)	10FM	5FM	0FM
Test (0.2% MFeed+)	10FM-MFeed+	5FM-MFeed+	0FM-MFeed+

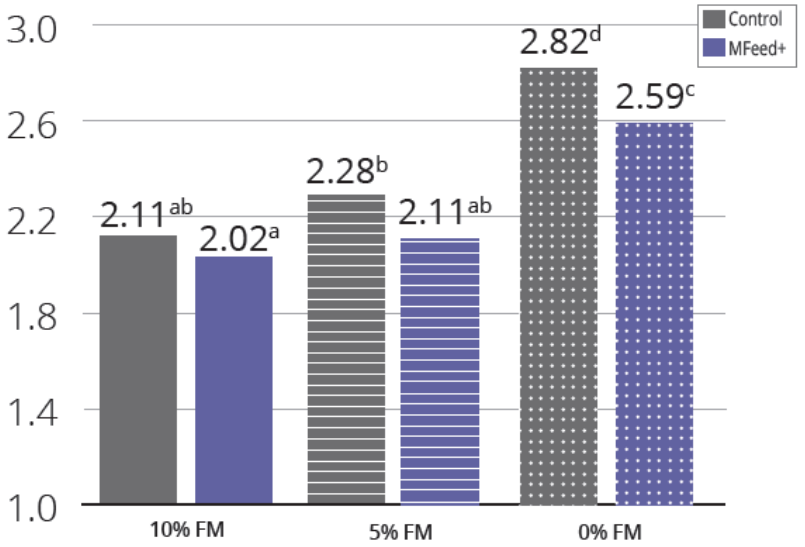
EFFICACY OF MFEED+ IN GIBEL CARP

SCIENTIFIC TRIAL, CHINA - 2017

→ **Final Weight (g)**



→ **Feed Conversion Ratio**

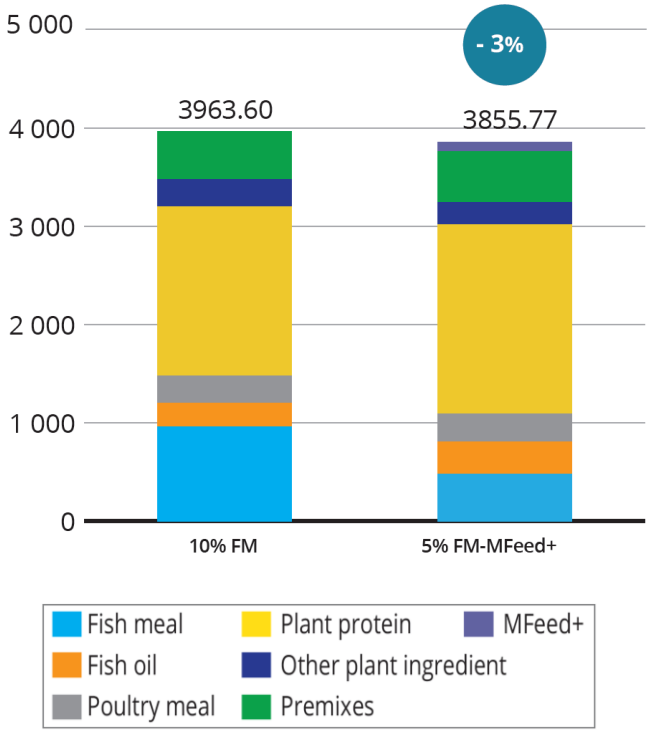


- Decreasing the level of FM in the diet strongly decreased performance
- MFeed+ had a positive effect on performance in each of the three diets

EFFICACY OF MFEED+ IN GIBEL CARP

SCIENTIFIC TRIAL, CHINA - 2017

→ **Formulation cost in Yuan/t feed**



- The current practice of 10% FM diets can be reduced to 5% FM when using MFeed+, in a cost-effective way: - 3% in feed cost with equivalent performance.

mFeed+

DOSAGE

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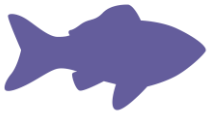
DOSAGE RECOMMENDATIONS

- **Poultry**
  - Broilers: 1kg/T in grower and finisher phases
  - Laying hens: 1kg/T in all phases

- **Pigs**
  - Fattening pigs: 1kg/T in grower feed and 0.5kg/T in finisher feed



- **Fish**
  - Grow out stages: 2kg/T

- **Shrimp**
  - Grow out stages: 2kg/T

mFeed+

BOOSTER OF ENZYMATIC ACTIVITY

IMPROVED USE OF INGESTED NUTRIENTS

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