

MAXIMIZING USE OF COPRA MEAL – NUTRIENT DENSE, BUT CHEAP RESOURCE:

MANNANASE PM™ – THE TARGETED ENZYME SPECIFICALLY DESIGNED TO DIGEST THE FIBERS/NSP IN COPRA MEAL

Copra meal, the by-product of oil extraction from copra, is nutrient dense, low cost considering its content, but poorly utilized. The poor utilization has been traced to very high levels of fiber, now more specifically referred to as Non-Starch Polysaccharides (NSP), that account for more than 50% of its weight/total content, and cause negative digestive and growth effects at high levels of incorporation.

WHY COPRA MEAL IS POORLY UTILIZED

TYPICAL ANALYSIS COPRA MEAL, PHIL. SAMPLES

Crude Protein	20.8%
Gross Energy	3210 kcal
TOTAL FIBER	51.3%
Neutral Detergent Fiber (NDF)	51.3%
1. Acid Detergent Fiber (ADF)	25.5%
2. Hemicellulose (HC)	25.8%
2.1 Betagalactomannan	>16.50%
2.2 Betaglucan	<3.60%
2.3 Betamannan	<2.50%
2.4 Others	<3.30%

NDF – Total Fiber ADF – cellulose + lignin, insoluble HC – soluble fibers

Copra meal Total Fiber or NDF comprise over half (>51%) of its weight. The NDF in turn is almost equally made up of the insoluble fiber ADF (cellulose + lignin) and the soluble fiber HC. Almost 64% of the HC is betagalactomannan (16.5% by weight of coprameal), with the rest made up of betaglucan (3.6% by weight), mannan (2.5% by weight) and other minor Hemicellulosic forms.

As fibers are indigestible to simple stomach animals, i.e. pigs and poultry, the actual digestible energy of copra meal for these animals is less than half, or only around 1600 kcal.

As NSPs are known to be very viscous and absorb over 5 times their weight in water, they in effect depress nutrient absorption in the intestines, and create a filling effect, restricting feed intake specially in poultry which have limited gut volume. Up to 40% of the protein can also be bound in the NSP matrix, reducing actual protein bioavailability.

These facts explain why traditional Copra meal use at >10% incorporation rate in pigs and >5% in poultry invariably lead to negative digestive and growth effects.

SCIENCE BASED SOLUTION

EXOGENOUS ENZYMES – effective tools in digesting NSPs in copra meal

Advancements in enzyme production, isolation, and purification have made possible the targeted, efficient and economic use of exogenous enzyme supplements as tools in improving digestibility and increasing utilization of high NSP feed ingredients, allowing maximized use of cheap but high-calorie potential ingredients, like copra meal, palm kernel meal, rice bran, pollard, and other agricultural products and by-products, **without the usual digestive and growth depressant effects**. In the industrial field, for example, the targeted use of *cellulase* has very significantly increased the efficiency of ethanol production from high cellulosic agricultural materials.

WHY ENZYME USE IS TARGETED

1. Specificity in action

Enzyme activity is a target substrate specific – meaning an enzyme will act only on the specific substance it was designed for. Thus, *lactase* enzyme will act only on lactose, *cellulase* will act only on cellulose, *mannanase* will act only on mannans, and *betagalactomannanase* will act only on betagalactomannan.

This specificity is more aptly described as a “**lock and key**” principle – a specific key can only work on the lock it was made for.

2. Enzyme:target substrate concentration

In the live animal, as the movement of food from the mouth to the first part of the intestines (anterior duodenum) is time constrained (more or less 30 minutes in the pig), the amount of enzyme supplemented must be sufficient to digest the expected amount of target substrate in the feed within the transit time, or else, whatever substrate is digested after the duodenum will no longer be absorbed as desired.

Thus, the dose of the enzyme supplement must be target ingredient inclusion rate dependent – meaning it is increased or decreased according to the incorporation level of target ingredient.

PELLETING HEAT IMPACT

The supplement must retain enough desired activity after exposure to pelleting heat (>85degC). Enzymes are proteins, therefore inherently sensitive to heat. Thus, as a general rule, enzymes are recommended for post-pelleting application.

HOW WILL I KNOW MY ENZYME SUPPLEMENT WORKS

OBSERVABLE, MEASURABLE IMPACT OF ENZYME SUPPLEMENTATION

Manure size, consistency and form

As these enzyme supplements break down indigestible materials which normally end up as manure, the significantly reduced size of manure must therefore be a readily observable enzyme effect, and can usually be seen the next day. Drier and well formed manure will also be evidence of reduced manure NSP content.

Laboratory Assay of Manure

The level of enzymatic degradation of NSPs in the feed can be accurately documented thru the measurement of NDF, ADF and HC in the manure.

Weight gains/FCR

Achieved additional ADG and FCR gains will be proportional to digestibility and nutrient bioavailability improvements.

MANNANASE PM™ – targeted enzyme for Copra meal

MANNANASE PM™ is the only enzyme supplement in the market designed specifically for copra meal, the result of decades of scientific studies on copra meal fiber and digestibility characteristics, and validating the enzyme isolates selection and combinations to effectively digest the copra meal NSP matrix. Tested en-vitro and en-vivo, then to on- farm pigs and poultry, minute adjustments were incorporated in its design to achieve a working final product.

MANNANASE PM™ in its current form, is produced from purified enzyme isolates. The main active components are *betagalactomannanase* and *cellulase* with significant *betaglucanase* minor activities. The product is rated to **impact over 70% of the HC and over 55% of the ADF of copra meal** (pls see above copra meal NDF profile).

MANNANASE PM™ allows copra meal incorporation rates beyond 20% in pigs (>10% in poultry), as majority of the fibers responsible for the negative digestive effects are effectively degraded into bioavailable forms.**

MANNANASE PM™ consistently produces significant and measurable productivity gains (growth, FCR), cost reductions (cost/kg of feed and cost/unit of production), and marked reduction in manure waste/effluent output.

MANNANASE PM™ is stable at pelleting temperatures, established by independent laboratories to retain >83% enzyme activity at normal pelleting temperatures.***

It must be clarified that the product **MANNANASE PM™** is completely different from the enzyme *mannanase*, the active ingredient in other competing products being presented as copra meal enzyme; *mannanase digests only mannans*, which comprise less than 2.5% of copra meal weight (or 5% of total NDF/Fiber), thus capable of impacting only a maximum of 5% of the NSP of copra .

OBSERVABLE AND MEASURABLE IMPACT OF MANNANASE PM™

FCR impact - **>13% improvement over unsupplemented rations, at similar or better ADG**

Feed cost - **7% to 12% reduction, depending on copra meal, soybean meal and corn price**

Manure size, fiber content profile and form - **>30% reduction of manure size and volume;
>29% reduction in manure NDF, >21% reduction in manure ADF, >38% reduction in manure HC contents; well formed, drier manure compared to unsupplemented rations**

Expected Energy release - **swine* - 1059kcal/kg of copra meal
104 to 390kcal/kg in other ingredients
Poultry* - 1130kcal/kg of copra meal
128 to 516kcal/kg in other ingredients**

*pls refer to attached expected energy release tables

**Data from controlled studies show that 30% copra meal incorporation rate is the threshold – meaning incorporation rates beyond 30% will negatively impact ADG and FCR)

***client commissioned assay, done by independent laboratory

SUMMARY OF PERFORMANCE TRIALS

I. Effect of Mannanase PM on copra meal , In Rat Digestibility Trials, Agriaccess, US, 1997-2001

>44% of Acid Detergent Fiber (ADF) degraded
>59% of Hemicelluloses degraded
>52% of Neutral Detergent Fiber degraded
Over 1,000 estimated kcal of trapped energy (in HC, ADF and proteins) released

II. Effects of *Betagalactomannase* Supplementation in High Copra Meal Levels in Growing Finishing Swine, adapted fr. C. M. Bautista. MS in Nutrition Thesis, Univ. of the Phil. at Los Banos. Phil. 2009, unpubl.

Ration – 20% to 35% Copra meal, with and without Mannanase PM supplementation
60 day feeding

Higher ave. final weight gain by up to 5.5 kg/hd
Better ADG by >13% (> 100gms/hd/day)
Better feed efficiency by up to 13.7%
Confirms that 25% Copra meal level is the OPTIMUM betagalactomannase supplemented incorporation rate for growing-finishing/adult pigs
Establishes 30% copra meal incorporation rate as the “threshold” level

III. Effect of *Betagalactomannanase* Supplementation on Manure Fiber & Moisture Profile, Broiler Grower Finisher Feed. adapt. from T. Villaver and M. Abella, DVM Thesis, CLSU, Munoz, N.E., Phil. 2009,unpubl.

Ration – 10% copra meal incorporation in commercial broiler grower finisher ration

Control - no enzyme supplement

Treatments - with Mannanase PM enzyme supplement

5gm/kg (T1) and 7.5gm/kg (T2) of copra meal incorp.

Manure of Treatment groups have >29% lower NDF,> 21% lower ADF,> 38% lower HC and > 11% lower moisture than Control Manure

IV. Independent Assay of MANNANASE PM™, client commissioned, done by Pacific Labs, Sing., 2009

Activity and Thermal Stability *Betagalactomannanase/gm (BGM/g)*

Room temperature 1,035 units

Heat treatment, 85degC, 1 min 863 units

Retains >83% activity post pelleting temperature

IV. On Farm Swine Trial , Quezon Prov., Phil.

Rations - 20% copra meal + Mannanase PM versus standard corn-soy

Lactation and Breeder rations 500 sow unit

6.49% higher birth weight 4.73% bigger litter size 36% reduction in stillbirth

56% reduction of mortality at weaning 9.12% improvement in weaning weight

37.98% more piglets weighing 7kg and above at weaning

44.53% less piglets weighing below 6 kg at weaning 7.67% better survival rate at weaning

Manure smaller, firmer, well formed, volume lesser by over 36%

Feed cost Reduction by 6.92%

V. On Farm Layer Trial, Camarines Sur, Phil.

Ration - 10% Copra meal + Mannanase PM versus standard corn soy

960 birds/group, post peak , 80 day feeding trial

0.17% better ave. daily egg collection

5.66% lower feed cost/kg

5.98% lower feed cost/bird/day

6.25% lower feed cost/egg

Smaller, more compact and drier manure

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