Xylamax®

Unique xylanase scientifically designed for consistent premium performance

BRI®

Scientifically Designed and Developed

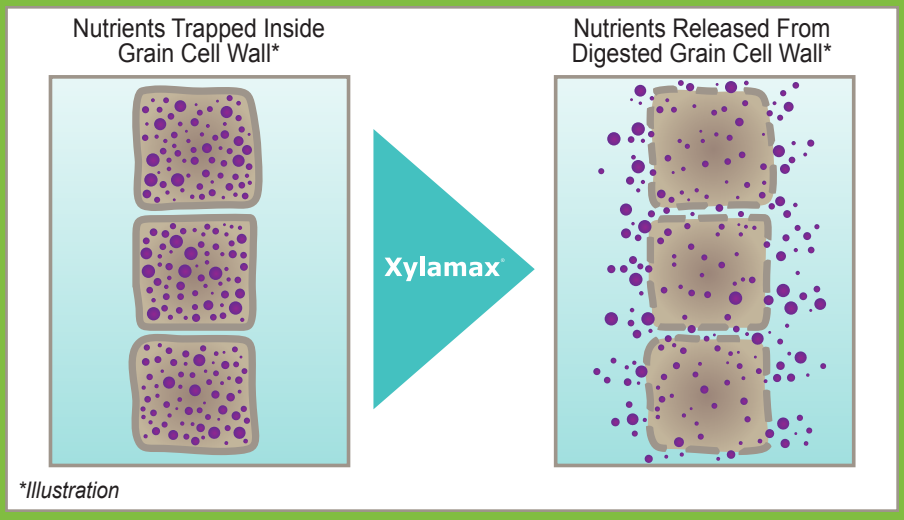
Xylamax® is a unique high quality xylanase enzyme that helps producers improve animal nutrition and gut health in a safe and sustainable way. It has been scientifically developed to consistently deliver premium performance across a wide range of feed formulations, production environments and practices used around the world.

An endo-1,4-beta-xylanase, Xylamax was developed by BRI scientists from a unique gene found in a naturally occurring fungal micro-organism. The primary function of xylanase enzymes is to break down xylans, a type of non-starch polysaccharide (NSP) found in the cell walls of corn and other grains, so that they are more easily digested by poultry. Xylamax performs this function extraordinarily well because of its unique protein structure and pH activity profile.

Xylamax Mode of Action

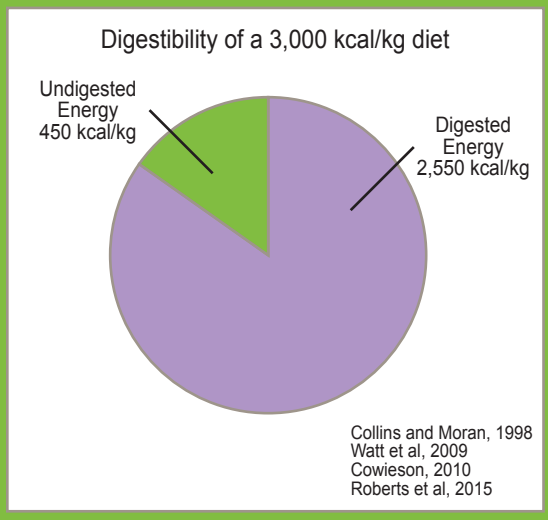
Research confirms that 450-500 kcal/kg of valuable energy in a typical poultry diet is not digestible. The addition of enzyme feed additives has been shown to make up to 30% (135 kcal/kg) of this energy digestible (Cowieson, 2010). Xylans are the most prevalent type of NSP in poultry feed grains, representing up to 43% of the total NSP content. Xylanase enzymes hydrolyze glycosidic bonds in xylans that make up cell walls, resulting in the release of the encapsulated nutrients.

Xylamax Activates Nutrient Release by Breaking Down Components of Grain Cell Walls



Illustration

Negative Impact of Xylans in Animal Feed



Collins and Moran, 1998
Watt et al, 2009
Cowieson, 2010
Roberts et al, 2015

Xylamax®

Unique Protein Structure Maximizes Energy Release

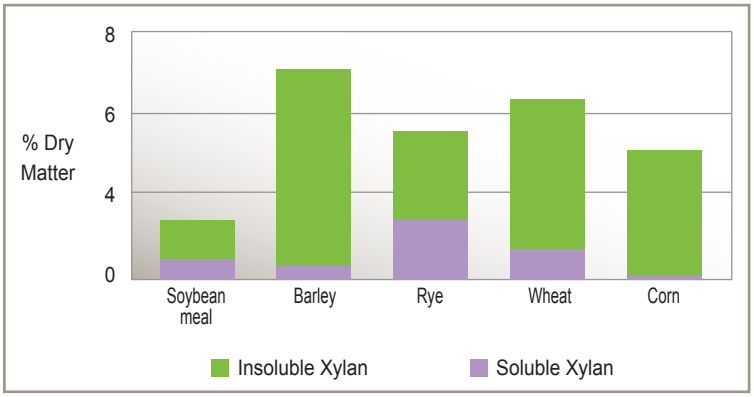
Xylans occur in two types, water soluble and water insoluble. There are two families of xylanase enzymes used in animal feed, GH10 which primarily hydrolyzes soluble xylans and GH11 which more effectively hydrolyzes both soluble and insoluble xylans (Berrin and Juge, 2008).

Typical GH10 Xylanase

Typical GH11 Xylanase

To maximize release of encapsulated nutrients in feed grains, the correct type of xylanase enzyme is required. For example, 98% of the xylan content in corn is insoluble. In order for poultry to digest a typical corn-SBM diet, a xylanase which targets insoluble xylans (GH11), such as Xylamax, is required.

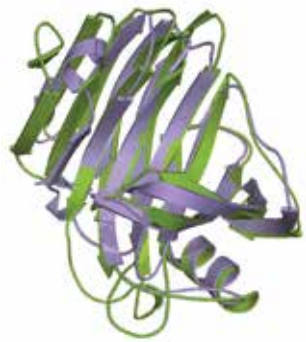
GH11 Xylanase Hydrolyzes Both Soluble and Insoluble Xylans In Corn-SBM Diets



(Choct, 1997)

Xylamax is a unique GH11 xylanase with an extended enzymatic site which allows for greater catalytic activity.

Xylamax



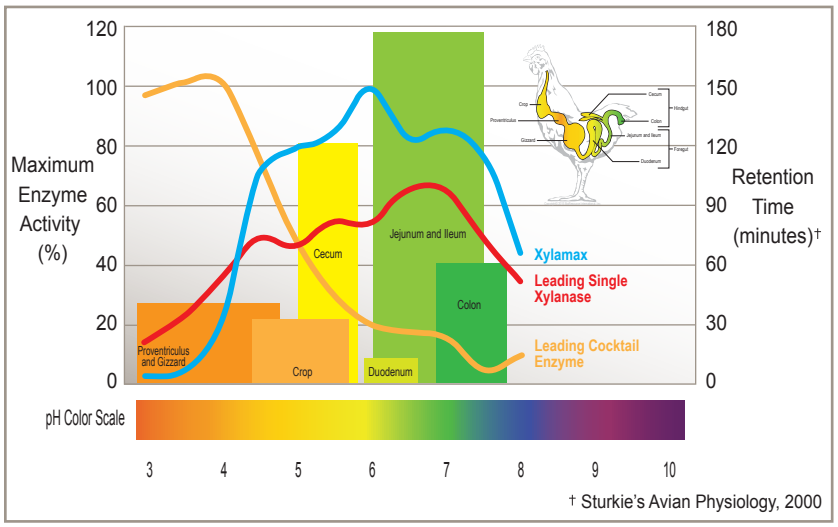
Xylamax Overlayed on Typical GH11 Xylanase

Unique pH Activity Profile Increases Nutrient Absorption

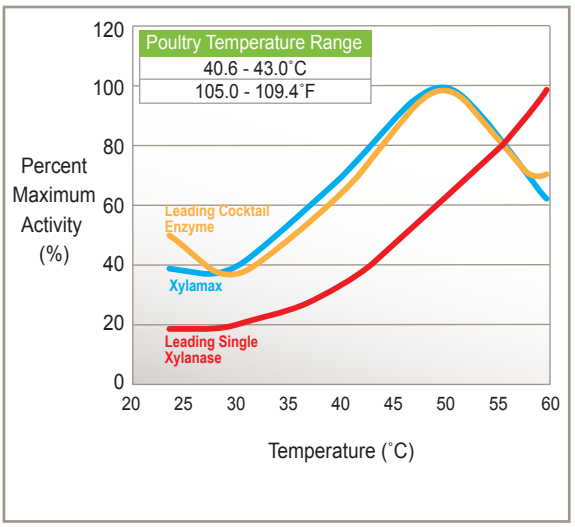
The Impact of Enzyme pH Profile

Feed digestion occurs mainly in the small intestine of poultry (duodenum, jejunum, ileum) as evidenced by the amount of time the digesta material remains in these areas of the bird's gut. The majority of absorption of nutrients also occurs in the small intestine due to the presence of a higher number of villi, the site of nutrient absorption. For any enzyme to deliver maximum results, it needs to work optimally at the 5.7-7.0 pH range occurring in the small intestine (Sturkie, 2000). Xylamax is the highest activity enzyme in this range.

Optimum Activity Where Majority of Digestion Takes Place



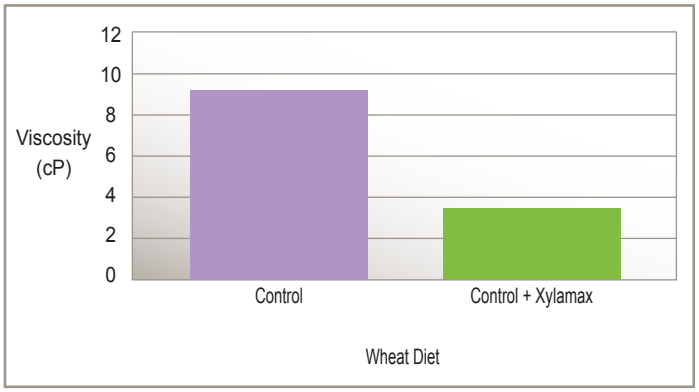
Xylanase Activity x Temperature Profile



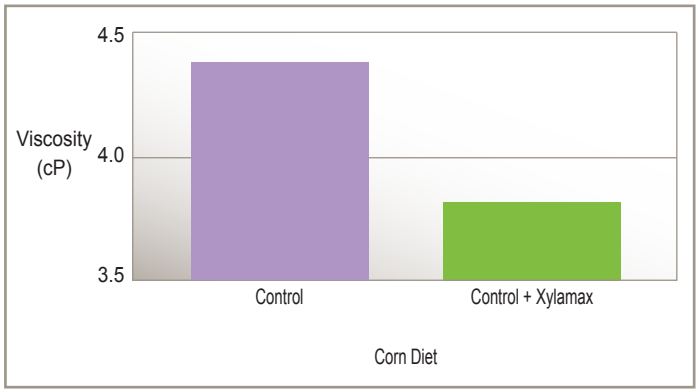
The Impact of Digesta Viscosity

A highly viscous composition of the digested material in the bird's intestine causes a decrease in the passage rate through the gastrointestinal tract. As a result, nutrient diffusion and absorption in the foregut is reduced, and unabsorbed nutrients are allowed to enter the hindgut where they facilitate the proliferation of detrimental bacteria. High digesta viscosity further impairs poultry nutrition by reducing feed intake.

Xylamax Accelerates Nutrient Absorption by Reducing Digesta Viscosity and Improving Passage Rate



(NC, USA 2014)



(NC, USA 2014)

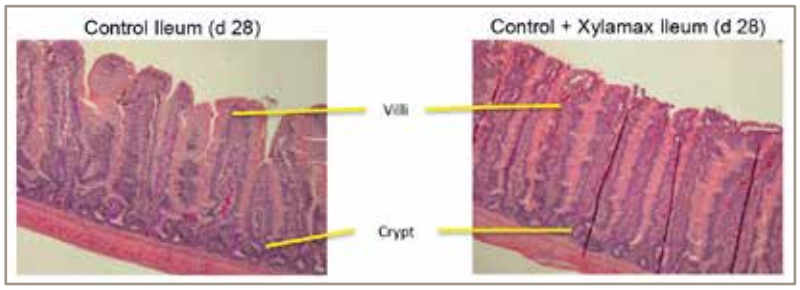
Naturally Improves Gut Health

Not only do undigested xylans limit nutrient availability, increase digesta viscosity and reduce nutrient absorption and utilization by the bird, they may also contribute to the growth of intestinal pathogens that thrive on undigested nutrients in the feed. Proliferation of these pathogens is associated with compromised morphological development of the gut mucosa, pathogen-induced gut inflammation, oxidative stress and tissue damage. By effectively degrading xylans found in grains, Xylamax improves the overall gut health of animals.

Impact on Mucosal Morphology and Growth of Pathogens

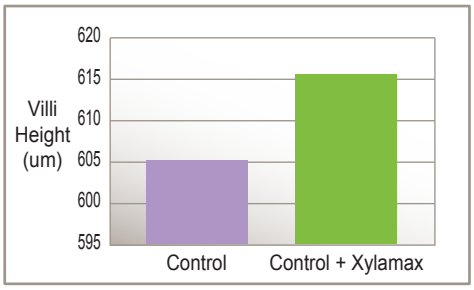
By effectively attacking the detrimental effects of xylans, Xylamax limits growth of pathogens in the intestine while improving the bird's nutrient absorption and utilization because of higher nutrient digestibility and improved gut function, as indicated by increased villi height in the presence of Xylamax in feed.

Xylamax Improves Mucosal Morphology



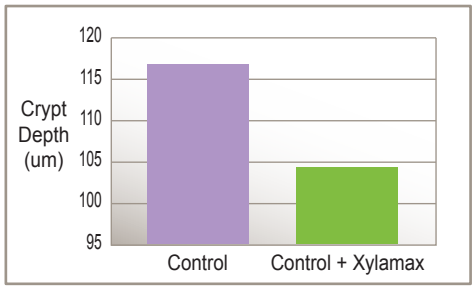
(NC, USA 2015)

Xylamax Increases Villi Height

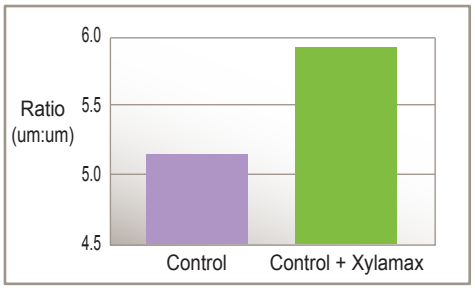


(NC, USA 2015)

Xylamax Increases Crypt Depth



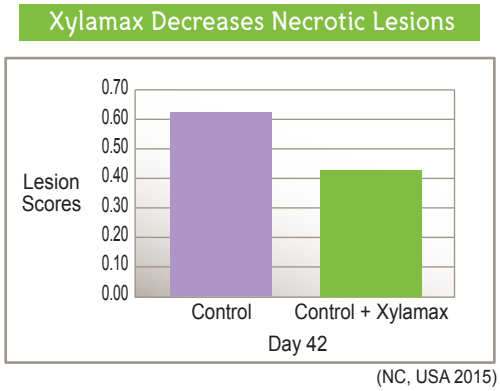
Xylamax Increases Height:Depth Ratio



Decreased Severity of Necrotic Lesions

Necrotic Enteritis, characterized by *Clostridium perfringens*, costs the global poultry industry about $2 billion annually (Ducatelle and Immerseel, 2010). Necrotic Enteritis causes necrotic lesions in the intestinal tract, poor digestion, reduced weight gain, increased FCR, and even death. In a 42-day pen trial, birds were fed a typical corn-soy diet and were challenged with *C. perfringens* (10^7/bird). Necrotic lesions in birds supplemented with Xylamax were significantly less severe than in birds that were not supplemented with the enzyme, contributing to the overall gut health of the birds.

Xylamax Decreases Necrotic Lesions

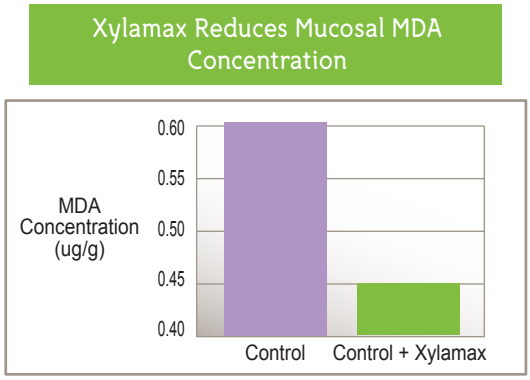


(NC, USA 2015)

Naturally Improves Gut Health

Reduction of Oxidative Stress and Mucin Secretion

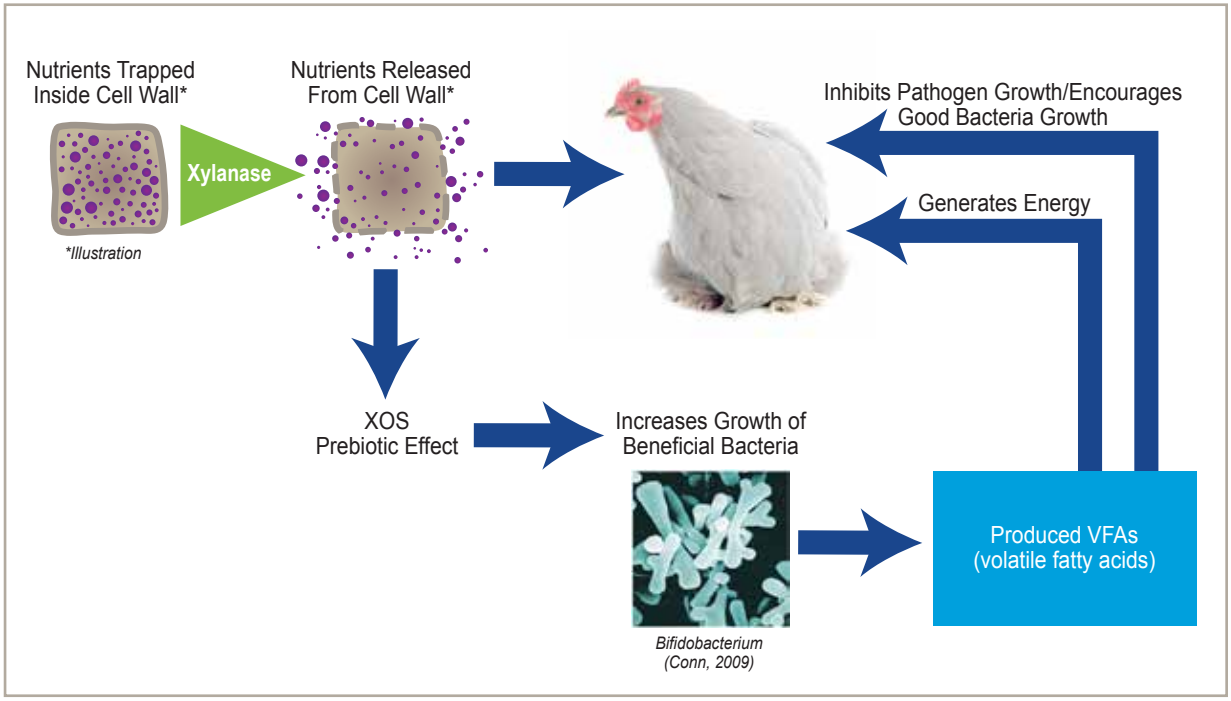
A healthy gut can be measured not only by mucosal morphology but also by indicators of oxidative stress, such as malondialdehyde (MDA). Increases in MDA have been associated with suppressed gut development, reduced growth performance and poor feed efficiency in broilers. Supplementation of Xylamax in broiler feed has been shown to reduce MDA concentrations in serum and mucosa.



(NC, USA 2015)

Creation of Prebiotic Effect

In addition to limiting the growth of pathogens through improved nutrient digestibility, Xylamax helps maintain the healthy microbiota by producing xylo-oligosccharides (XOS), which preferentially promotes the growth of beneficial bacteria, such as *Bifidobacterium* and *Lactobacillius* in the foregut. This prebiotic effect offers the host additional protection against potential pathogenic challenges, allowing more consistent performance in various commercial settings.



Versatile Solution, Consistent Performance

Xylamax delivers consistently high performance across a range of feed ingredients as shown in animal feeding trials conducted by internationally recognized independent poultry research institutions. All BRI products are manufactured in accordance with world class GMP and FAMI-QS standards to ensure a consistent high quality product from batch to batch.

Flexible Feed Formulation Strategies

Reformulation Strategy - Recommended

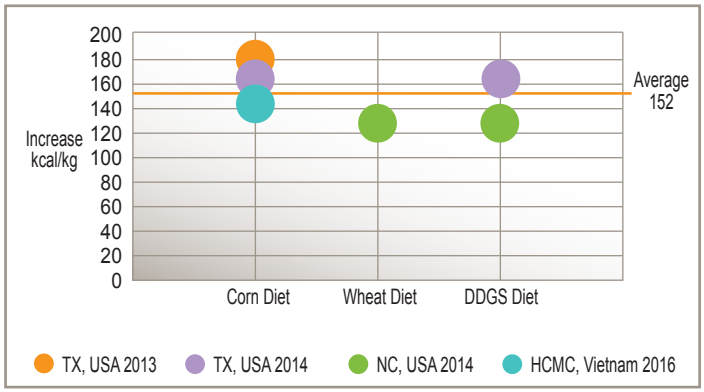
Reformulate diet to take advantage of additional energy release

Use Xylamax matrix value calculator to determine maximum matrix value based on feed formulation

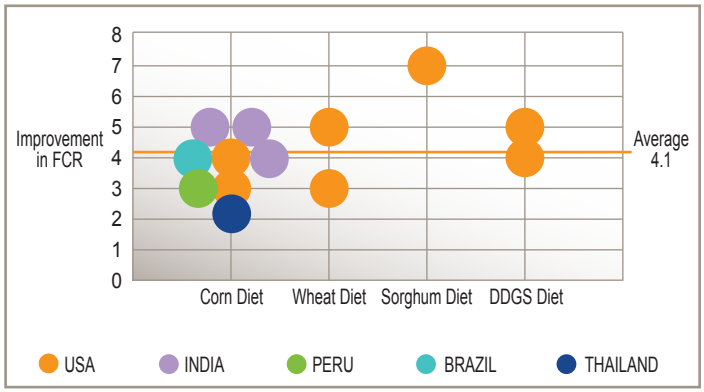
On-top Strategy

Add Xylamax on top of current diet to improve FCR by 4-6 points based on feed formulation and Xylamax dose

Xylamax Increases Energy Digestibility by 152 kcal/kg

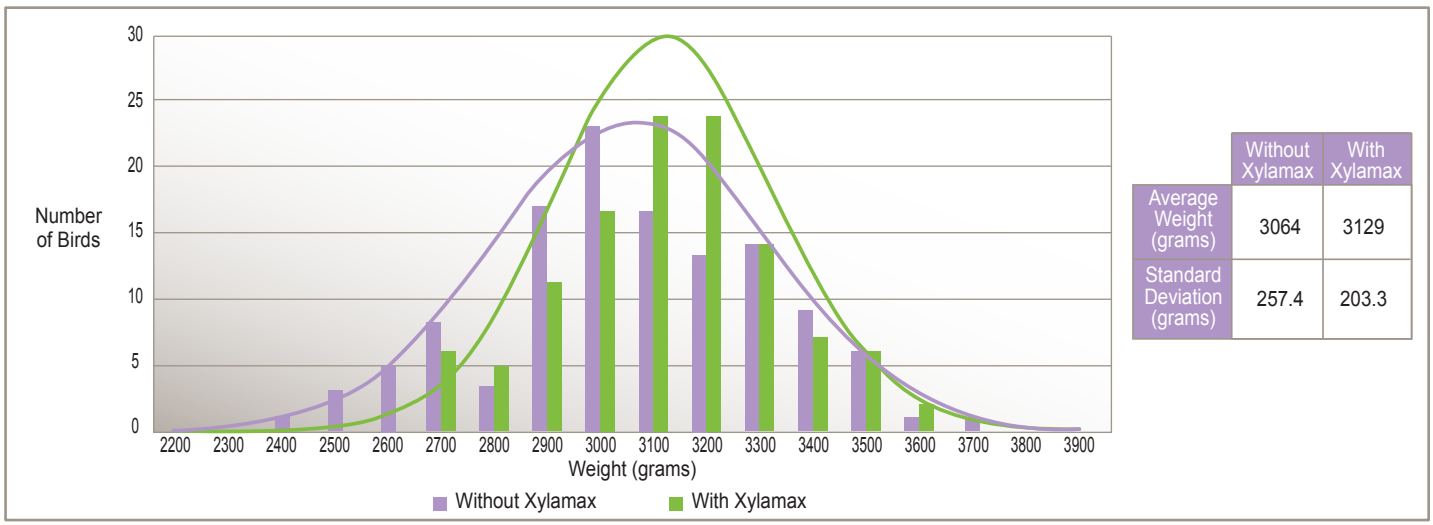


Xylamax Improves FCR by 4.1 Points



(See references on back page)

Xylamax Improves Average Bird Weight and Flock Uniformity



	Without Xylamax	With Xylamax
Average Weight (grams)	3064	3129
Standard Deviation (grams)	257.4	203.3

(NC, USA 2013)

Birds treated with Xylamax are heavier on average than birds not treated with an enzyme. Furthermore, a larger proportion of the birds are closer to the average weight, improving flock uniformity. Xylamax treatment contributes to a heavier, less variable flock.

Specifications

Form: Uncoated powder feed additive

Thermostability: Xylamax is thermostable at pelleting temperatures up to at least 85ºC

Dosage:

Xylamax 100	Xylamax 500
50-100g/MT dose	250-500g/MT dose
150,000 XU/g activity	30,000 XU/g activity
10kg bag	25kg bag

Energy Release: Xylamax provides **up to 130 kcal ME/kg** in corn-based poultry diets, and **up to 150 kcal ME/kg** in wheat-based poultry diets.

Recent Xylamax Animal Trials

Research Institutions	Country	Year	Principal Investigator
Nong Lam University, HoChiMinh City	Vietnam	2016	D. Dong
Bangkok Animal Research Center, Samut Praken	Thailand	2016	T. Sooksridang
Universidad Nacional Mayor de San Marcos, Veterinary Medicine Faculty, Avian Pathology Laboratory experimental farm, San Borja district, Lima	Peru	2016	E. Icochea
Federal University of Viçosa, Center for Agricultural Sciences, Dept of Animal Science – Viçosa, Minas Gerais	Brazil	2016	H. Rostagno
NC State University	USA	2016	S. Kim
Annam Feeds Research and Development Trial Farm	India	2016	C. Chandrasekaran
Universidade Federal Do Rio Grande Do Sul	Brazil	2015	S.Viera
NC State University	USA	2014	P. Biggs
NC State University	USA	2014	J. Grimes
Indian Council of Agricultural Research	India	2014	R. Rao
Texas A&M University	USA	2014	J. Lee
NC State University	USA	2014	P. Biggs
Indian Council of Agricultural Research	India	2014	R. Rao
NC State University	USA	2014	J. Tyus
Texas A&M University	USA	2013	J. Lee

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