



THE FLEXIBLE NSP-ENZYME

Take the chance.
Pick the economical solution.

NEW!
EU approval for 5 species!



Natugrain[®] TS

BASF Nutrition – the healthy decision.

BASF

The Chemical Company



AT A GLANCE

- EU APPROVAL FOR 5 SPECIES
- EXCELLENT PROCESSING PROPERTIES
- HIGH EFFICACY
- EXCEPTIONAL STABILITY



THE FLEXIBLE NSP-ENZYME!

The NSP Problem

Non-starch polysaccharides (NSPs) are virtually indigestible compounds in vegetable feedstuffs used for pig and poultry nutrition. Their anti-nutritional effects reduce the efficiency of the feeds by trapping valuable nutrients, thus preventing them from being digested. Furthermore, particularly in broilers, the intestinal digesta may become extremely viscous due to the high NSP content in the diet. Since the activity of endogenous digestive enzymes is limited, this results in sticky droppings and

impaired litter quality. This, in turn, may lead to poor hygienic conditions and, in layers, to a higher percentage of dirty eggs.

Why should Natugrain TS be added to the feed?

Natugrain TS, the feed enzyme product from BASF, contains the highly purified NSP-splitting enzymes endo-1,4-beta-xylanase and endo-1,4-beta-glucanase. The enzymes are produced by fermentation using BASF's own production strain, a fungus of the species *Aspergillus*. Due

to well balanced enzyme activities, Natugrain TS is well suited to counteract the anti-nutritional effects from pentosans and β -glucans that constitute the major part of NSPs in commonly used feedstuffs (Table 1). Natugrain TS improves the nutritive value of diets containing NSP-rich components such as wheat, barley, rye, triticale, oat, sunflower and a number of milling by-products. Apart from this Natugrain TS can be effective in corn/soy diets by releasing additional energy.

Table 1: Content of pentosans and β -glucans in different cereal grains

Cereal grain	Pentosans		β -Glucans	
	Total (g/kg)	Soluble in water (g/kg)	Total (g/kg)	Soluble in water (g/kg)
Rye	58 - 122	19 - 27	13 - 47	-
Triticale	46 - 86	6 - 11	7 - 36	-
Wheat	54 - 83	8 - 14	4.5 - 8.5	-
Oat	37 - 80	8	23 - 51	16
Barley	31 - 77	5 - 10	26 - 66	24 - 50
Corn	43 - 68	4 - 6	0.8 - 1.7	-

Source: Jeroch, 1994 (modified)

HIGH EFFICACY IN PIGS AND POULTRY

EU APPROVAL FOR 5 SPECIES

High efficacy proven in feeding trials

Natugrain TS improves animal performance parameters like feed conversion rate (Figure 1) and daily weight gain (Figure 2).

In laying hens, feed costs can be reduced by lowering the feed consumption per egg (Figure 3), without having a negative impact on egg size or quality due to supplementation with Natugrain TS. All in all, the addition of Natugrain TS to pig and poultry diets is a valuable and reliable tool for reducing feed costs and optimizing animal production.

Figure 1: Natugrain TS improves the FCR in broilers fed with a wheat/rye-based diet

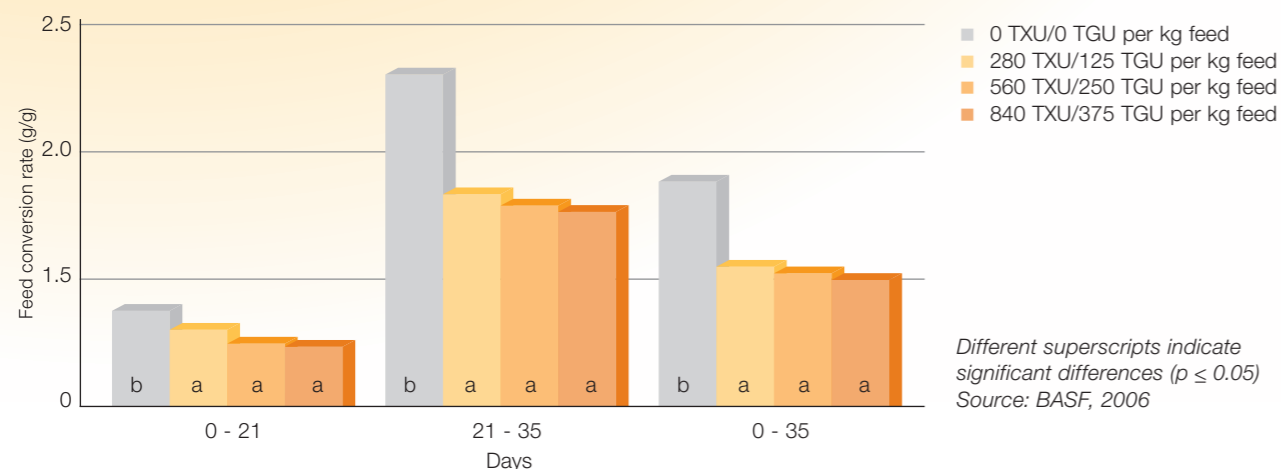


Figure 2: Improved DWG in piglets fed with a wheat/barley-based diet

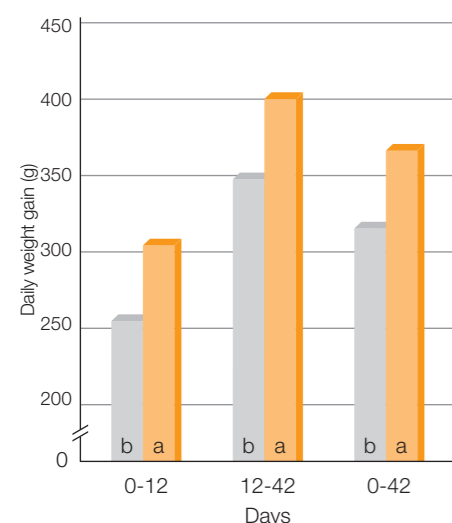
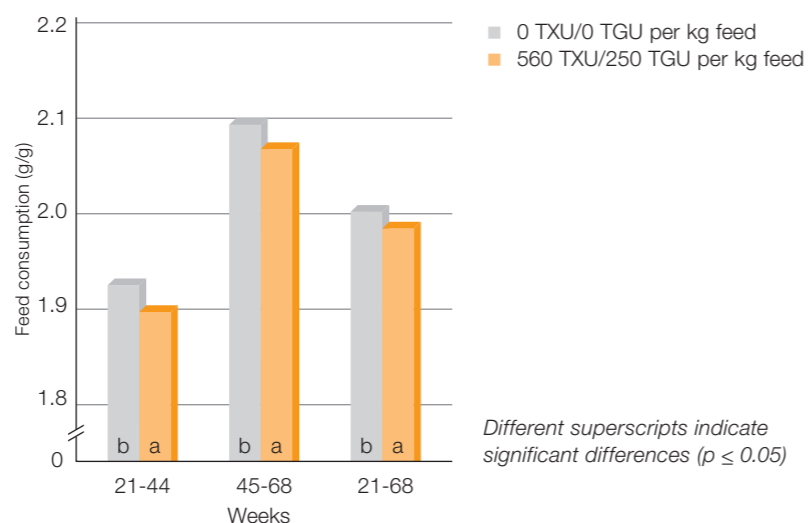


Figure 3: Impact on FC per egg when added to a wheat/rye-based layer diet



Source: University of Piacenza, Italy 2006

Source: IRTA, Spain 2006

Regulatory situation

High biological efficacy was one of the most decisive factors in the development of Natugrain TS. Indeed, its convincing beneficial effects in the digestive tract of animals led to the

approval by the European Commission of two Natugrain TS formulations, in each case for 5 animal species at one go: the dry type "Natugrain TS" and the liquid type "Natugrain TS L" (Table 2). This offers the feed pro-

ducer greater flexibility and many advantages since one product can be used for almost all NSP-enzyme relevant diets.

Reg. Nr.	Product	Active Additive	Minimum activity per product	Species	Minimum units of activity per kilogram of complete feed per animal species (TXU ¹ /TGU ²)
4a7	Natugrain TS (powder)	Endo-1,4-β-xylanase (EC 3.2.1.8) Endo-1,4-β-glucanase (EC 3.2.1.4)	5600 TXU ¹ /g 2500 TGU ² /g	Broiler, turkey, duck, layer, piglet	280/125, 560/250, 280/125, 560/250, 560/250
4a7	Natugrain TS L (liquid)	Endo-1,4-beta-xylanase (EC 3.2.1.8) Endo-1,4-beta-glucanase (EC 3.2.1.4)	5600 TXU ¹ /g 2500 TGU ² /g	Broiler, turkey, duck, layer, piglet	280/125, 560/250, 280/125, 560/250, 560/250

¹) Thermo-stable Xylanase Unit; ²) Thermo-stable Glucanase Unit

Dose recommendations

The economically optimal dose rate varies depending on the wheat, rye, barley and triticale contents. In addition, it is influenced by the cost of these raw materials, and also by

their quality (i.e. the amounts of anti-nutritive substances they contain). Based on numerous feeding trials, the following dose levels can be recommended as a general guideline (Table 3):

Wheat / Rye / Barley / Triticale in the diet	Animal species	Dose rate per kilogram of feed (TXU/TGU)	Dose rate per metric ton of feed (g)
≤ 40%	Broiler / duck	280 / 125	50
≤ 40%	Turkey / layer / piglet	560 / 250	100
40 - 60%	Broiler / duck / turkey / layer / piglet	560 / 250	100
> 60%	Broiler / duck / turkey / layer / piglet	560 - 840 / 250 - 375 ³⁾	100 - 150 ³⁾

³⁾ Depending on cereal NSP content, additional effects will occur at feed dose rates above 100 g/MT if the cereal content of the feed is over 60%

PREMIUM FORMULATIONS TARGETING ALL APPLICATIONS

THE NATUGRAIN PRODUCT PORTFOLIO

Product quality and stability

BASF's enzymes are high quality products. They are subject to stringent controls based on the best quality management standards possible. This provides the basis for the exceptional stability of Natugrain TS. Even having a guaranteed shelf life of 12 months when stored at 20°C, all Natugrain TS products are also able to withstand higher storage temperatures for several months (Figures 4, 5). It is BASF's high product quality standards in combination with its profound knowledge in enzyme production and application which are making Natugrain TS so successful. Feed millers value the excellent handling properties of Natugrain TS (Figure 6, 7).

Liquid or powder

BASF supplies Natugrain TS in two formulations: as a heat-resistant powder for direct mixing with the feed prior to pelleting (Natugrain TS), and as a liquid for spraying onto the pellets after they have cooled after pelleting (Natugrain TS L). The liquid formulation is recommended if the pelleting temperature exceeds 85°C.

Figure 4: Shelf life of Natugrain TS stored at 35°C

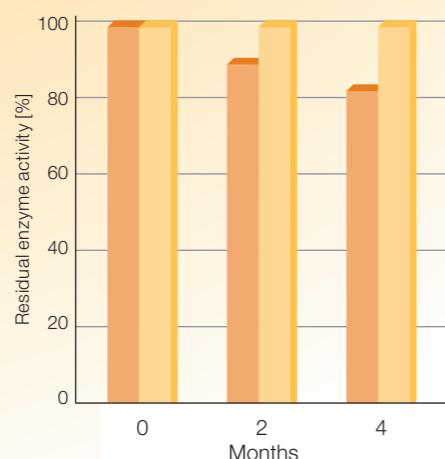


Figure 5: Shelflife of Natugrain TS L stored at 35°C

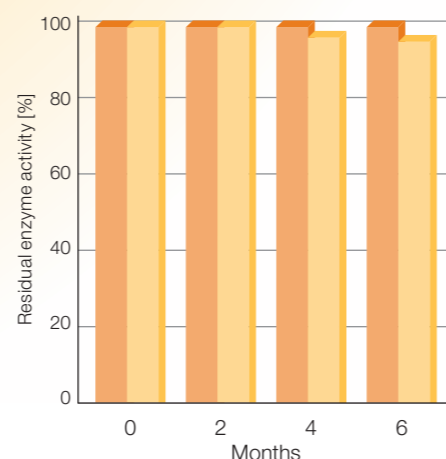


Figure 6: Stability of Natugrain TS at various pelleting temperatures (20 s conditioning time)

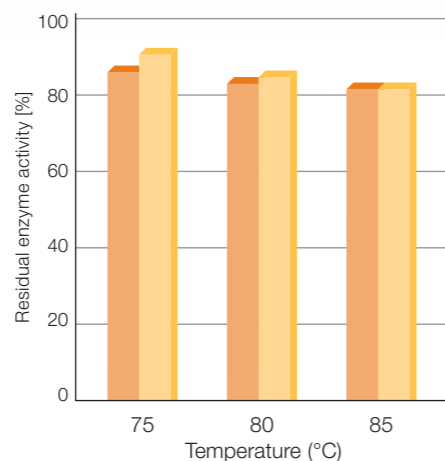
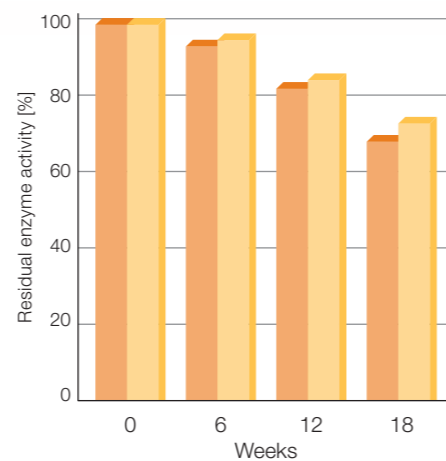


Figure 7: Stability of Natugrain TS in premix stored at 35°C



■ Thermo-stable Xylanase Unit (TXU)
■ Thermo-stable Glucanase Unit (TGU)

Source: BASF, 2007

EXCELLENT HANDLING PROPERTIES

The flexible enzyme for a broad range of diets

Product	Form	Additional Information	Product number
Natugrain TS	Powder	Endo-1,4-β-xylanase (5600 TXU/g) and endo-1,4-β-glucanase (2500 TGU/g), recommended for nonpelleted feed or pelleting up to 85°C	30285907
Natugrain TS L	Liquid	endo-1,4-β-xylanase (5600 TXU/g) and endo-1,4-β-glucanase (2500 TGU/g), recommended for postpelleting applications	30285884

The dedicated enzyme especially for wheat-based broiler and turkey diets

Product	Form	Additional Information	Product number
Natugrain Wheat TS	Powder	Endo-1,4-β-xylanase (5600 TXU/g), recommended for nonpelleted feed or pelleting up to 85°C	30269735
Natugrain Wheat TS L	Liquid	endo-1,4-β-xylanase (5600 TXU/g), recommended for postpelleting applications	30270056

The practical combination

Product	Form	Additional Information	Product number
Natuphos Combi TS L	Liquid	Phytase (5000 FTU/g) and endo-1,4-β-xylanase (5600 TXU/g), recommended for postpelleting applications	30363075

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Our S.E.T. initiative allows feed manufacturers to trace exactly the raw materials used while measuring the ecological and economical impact of the manufacturing process – at any time and anywhere in the world. By combining global traceability with the eco-efficiency analysis, BASF and its partners can measure sustainability throughout the entire value chain. We care about combining economic success with environmental protection and social responsibility throughout the entire supply chain. For more information please visit www.set-initiative.com.



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BASF's Nutrition Ingredients business unit is a leading supplier of feed additives. The product portfolio for animal nutrition includes vitamins, carotenoids, enzymes, organic acids and more. BASF offers products of outstanding quality produced with modern, state-of-the-art technologies. BASF also combines technical services and scientific expertise to meet the highest demands and to deliver the best value to the industry. Premium formulations are a key strength that has made BASF a leader in the industry. Further information is available at www.nutrition.basf.com

BASF Nutrition – the healthy decision.

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