Take the chance.
Pick the economical solution.

**Natugrain® TS**

BASF Nutrition – the healthy decision.
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

<table>
<thead>
<tr>
<th>Cereal grain</th>
<th>Pentosans</th>
<th>8-Glucans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (g/kg)</td>
<td>Soluble in water (g/kg)</td>
</tr>
<tr>
<td>Rye</td>
<td>58 - 122</td>
<td>10 - 27</td>
</tr>
<tr>
<td>Triticale</td>
<td>46 - 86</td>
<td>6 - 11</td>
</tr>
<tr>
<td>Wheat</td>
<td>54 - 83</td>
<td>8 - 14</td>
</tr>
<tr>
<td>Oat</td>
<td>37 - 80</td>
<td>8</td>
</tr>
<tr>
<td>Barley</td>
<td>31 - 77</td>
<td>5 - 10</td>
</tr>
<tr>
<td>Corn</td>
<td>43 - 68</td>
<td>4 - 6</td>
</tr>
</tbody>
</table>

Source: Jeroch, 1994 (modified)
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.

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

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):
**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.

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<table>
<thead>
<tr>
<th><strong>EXCELLENT HANDLING PROPERTIES</strong></th>
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**PREMIUM FORMULATIONS**

**TARGETING ALL APPLICATIONS**

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**THE NATUGRAIN PRODUCT PORTFOLIO**

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**The flexible enzyme for a broad range of diets**

<table>
<thead>
<tr>
<th>Product</th>
<th>Form</th>
<th>Additional Information</th>
<th>Product number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natugrain TS</td>
<td>Powder</td>
<td>Endo-1,4-8-xylanase (5600 TXU/g) and endo-1,4-8-glucanase (2500 TGU/g), recommended for nonpelleted feed or pelleting up to 85°C</td>
<td>30285907</td>
</tr>
<tr>
<td>Natugrain TS L</td>
<td>Liquid</td>
<td>endo-1,4-8-xylanase (5600 TXU/g) and endo-1,4-8-glucanase (2500 TGU/g), recommended for postpelleting applications</td>
<td>30285884</td>
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**The dedicated enzyme especially for wheat-based broiler and turkey diets**

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<tbody>
<tr>
<td>WheatTS</td>
<td>Powder</td>
<td>Endo-1,4-8-xylanase (5600 TXU/g), recommended for nonpelleted feed or pelleting up to 85°C</td>
<td>30269735</td>
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<tr>
<td>WheatTS L</td>
<td>Liquid</td>
<td>endo-1,4-8-xylanase (5600 TXU/g), recommended for postpelleting applications</td>
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**The practical combination**

<table>
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</thead>
<tbody>
<tr>
<td>Natuphos CombiTS L</td>
<td>Liquid</td>
<td>Phytase (5000 FTU/g) and endo-1,4-8-xylanase (5600 TXU/g), recommended for postpelleting applications</td>
<td>30363075</td>
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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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http://worldaccount.basf.com

Nutrition Ingredients

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.