Borregaard

SoyPass®

The bottom-line advantage

A SUSTAINABLE SOURCE OF RUMEN BYPASS PROTEIN

NUTRIVET

Adding value...
is our Life's work

SoyPass®

Soyabean meal is well known as a highly valuable protein source because of its high protein content and amino acid composition. SoyPass® is produced using a unique patented process which doubles the amount of bypass protein in soyabean meal.

The process takes advantage of naturally occurring wood sugar which, when mixed with soya binds to part of the protein, protecting it from digestion in the rumen. During production of SoyPass®, careful process control procedures ensure that the proteins become highly undegradable but retain the intestinal digestibility of untreated soyabean meal.

Research and development work since 1985 has demonstrated that the amino acids have not been damaged by the process and are highly digestible. Much of this research and development work took place before SoyPass® entered the commercial feed market in the USA and Europe, and was done jointly by LignoTech USA and the University of Nebraska.

DEGRADABLE AND UNDEGRADABLE PROTEIN

A better understanding of ruminant protein metabolism is allowing nutritionists to be more specific about the types of protein required for optimal animal performance.

Adequate amounts of degradable protein and energy are necessary to maximise rumen microbial activity, but excessive supply of rumen degradable protein can lead to metabolic inefficiencies, such as the need for energy to excrete the excess nitrogen or possibly a decrease in fertility.

The feeding of specific vegetable proteins designed to by-pass the rumen and to help balance amino acid uptake by the intestine can help improve animal efficiency and production.

SoyPass® ACTION

SoyPass® acts similarly to simple heat treatment to increase the bypass capacity of protein, by the binding of the soya protein with sugars, causing the Maillard reaction. This reaction, commonly known as toasting, binds the sugars to the protein, creating a bond which the rumen microbes cannot break. This bond is a physical blockage to the microbial enzymes, preventing them from binding to the protein chain, and thus from acting in their accepted fashion. Since all protease enzymes require specific binding sites in order to act, this stearic hindrance (blocking effect) decreases the amount of digestion which can be accomplished during the time that the protein is in the rumen (Figure 1).

However, this is only half of the story. It is easy to achieve very high levels of rumen protection by overcooking material, but this results in a decrease in digestibility, and a lower protein value for the animal. The manufacturers of bypass proteins have long since recognised this problem, and in consequence use precision control when temperature and time are involved in the production processes.

The mechanism by which protected proteins are digested in the abomasum and small intestine is of course the same mechanism which is used for unprotected proteins.

However there is an important factor in the digestion process which allows the proteins to be digested, since the binding sites for abomasal and pancreatic enzymes are blocked in the same way as those for bacterial proteases. The factor which allows binding is the low pH in the abomasum, since this causes limited denaturing of the protected protein (Figure 2).

Denaturing is basically the 'unravelling' of the tertiary (three dimensional) structure of the protein, which results in the stearic hindrance being removed, and the binding sites once more being available to the enzymes (Figure 3).

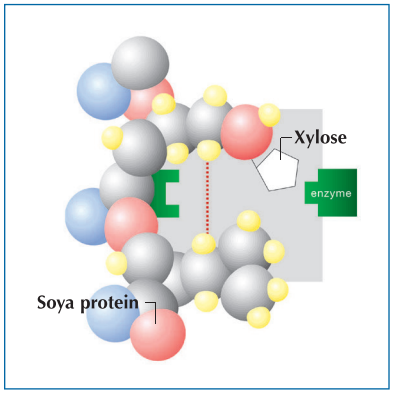


Figure 1:
Xylose binds to the soya protein molecule blocking the binding site for the protease enzyme

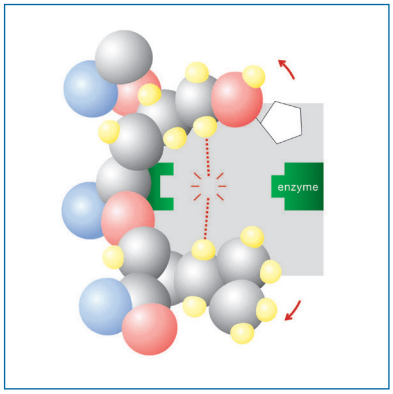


Figure 2:
Low pH in the abomasum causes the denaturing of the soya protein molecule, breaking hydrogen bonds

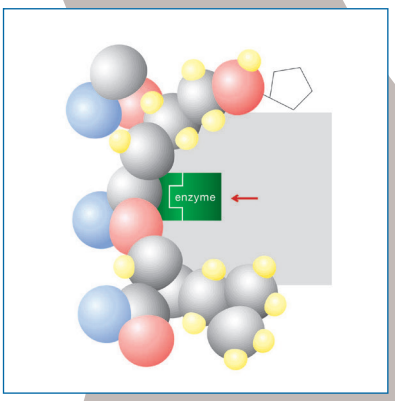


Figure 3:
The blocking effect of xylose is removed due to the unravelling of the protein molecule, allowing the enzyme to bind and resulting in full digestibility

TYPICAL ENERGY, DEGRADABILITY AND DIGESTIBILITY VALUES FOR SOYPASS® IN DIFFERENT NATIONAL SYSTEMS (DM BASIS)

Definitions of bypass calculations in national systems

UDP = 1-(a+(b*c)/(c+r))
Where:
a = immediately soluble protein
b = potentially degradable protein
c = rate of disappearance of b
} derived from nylon bag analysis
r = rumen outflow rate for the animal

American values	
Digestible rumen undegradable protein, % of CP	70.7
Digestibility of rumen undegradable protein, %	93
Acid detergent fibre insoluble protein (ADFIP), % of CP	3.16
Neutral detergent fibre insoluble protein (NDFIP), % of CP	53.3
NEl, Mcal/kg	2.215
NEm, Mcal/kg	2.113
NEg, Mcal/kg	1.478

British values	
DUP, g/Kg DM	340
ERDP, g/kg DM	130
ADIN, g/kg DM	1.2

French values	
PDIN, g/kg DM	378
PDIE, g/kg DM	353
PDIA, g/kg D	310
Theoretical Degradability, % CP	32.8
dsi	0.93
UFL, DM	1.11

Dutch	
BRE, g/kg DM	331
DVE, g/kg DM	361
OEB, g/kg DM	58
VEM, g/kg DM	980
FOS, g/kg DM	440
DOM, %	94.5
Digestibility of bypass protein, %	98.5

German	
UDP, %	65
nXP, g/kg	385
Ruminale stickstoffbilanz	+10
Milchvieh, MJ Nel/kg	7.5
Rima, MJ NE/kg	12

Nordic	
ATT, g/kg DM	300
PBV	90

American
Undegradable Intake Protein = UDP

Using an outflow rate of 0.06 for dairy cows.

British
DUP (Digestible Undegradable Protein) = 0.9 x ((UDP x CP) – Acid Detergent Fibre Insoluble Protein) where 0.9 is the proportion of amino acids in the true protein (a fixed value).

Outflow rate for dairy cows usually taken as 0.08.

French
PDIA = 1.11 x CP x (1-UDP) x dsi where dsi is the 'true digestibility of the UDP in the small intestine'.

Outflow rate for concentrate feeds in dairy cows taken as 0.08.

Dutch
DVBE = 1.11 x CP x (1-UDP) x %DVBE
%DVBE = the digestibility of the undegraded protein and is calculated by use of the residue from the long term (72h) in situ incubation. %DVBE = ((100-%UDP)-%RRE)/(100-%UDP) where RRE is the indigestible CP fraction after long term rumen incubation.

Outflow rate for dairy cows usually taken as 0.08.

German
Utilisable CP at the duodenum (uCP) denotes the sum of rumen microbial crude protein plus UDP.

uCP = [187.7 - (115.4 (UDP/CP))] DOM + 1.03 UDP.

Where DOM = digestible organic matter.

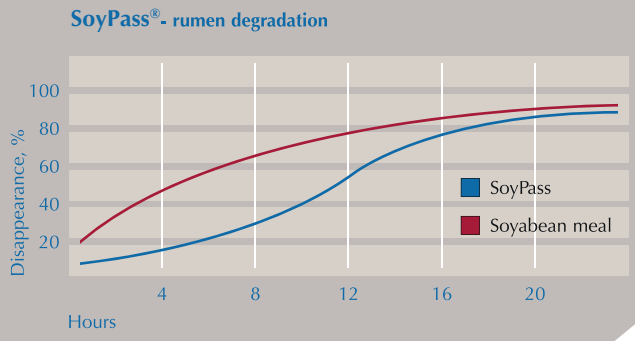
References:
1.Gesellschaft für Ernährungsphysiologie, 2001; Empfehlungen zur Energie-und Nährstoffversorgung der Milchkühe und Aufzuchtrinder. DLG, Frankfurt/Main, 2001.
2.P. Lebzien and J. Voigt, 1999. Calculation of utilizable crude protein at the duodenum of cattle by two different approaches. Arch. Anim. Nutr. 52, 363-369.

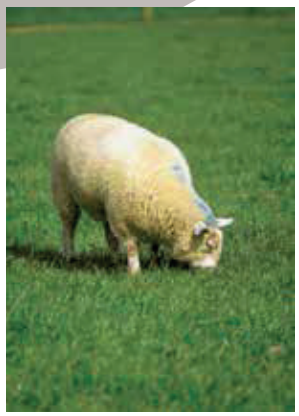
Nordic
Undegraded feed protein = CP x UDP x AA content of CP x 0.82 where 0.82 is the digestibility of the amino acids (a fixed value).

Outflow rate for dairy cows varies between the Scandinavian countries, from 0.05 in Finland to 0.08 in Sweden.

SoyPass® PROTECTION

The amount of bypass protein in a product is traditionally measured using the nylon bag approach, although other methods are now being attempted. Samples of the product are placed in an open mesh nylon bag, and placed in the rumen of a cow for fixed periods of time. After this time, they are removed, and the amount of material remaining is analysed, to allow the calculation of the undegradable protein content (UDP). Slight variations of this technique are used in each national system, but comparing SoyPass® with soyabean meal allows the benefit of the toasting process to be observed. The lower amount of protein disappearing compared to soyabean meal indicates the protection of protein due to the treatment received by SoyPass®. This technique can also be used to indicate the digestibility of products. If untreated soyabean meal and SoyPass® were of similar digestibility, then the amount of protein disappearing in the rumen over an extended time (usually 72 hours) would be the same.





HOW MUCH SoyPass® ?

Many feeding trials have been done with SoyPass® over the years, and different approaches have been taken to compare SoyPass® with soyabean meal. In one trial, soyabean meal (3.35 kg/d) was replaced with half the weight (1.60 kg/d) of SoyPass® in the ration, in an attempt to determine the lowest level of crude protein which could support milk yields of around 38 kg/d. The difference in the ration was made up by including additional maize, since this would have a beneficial effect on decreasing the protein content of the diet.

	SoyPass®	SBM
No cows	18	18
Dry matter intake, kg/d	23.6	23.9
SoyPass® or SBM, kg/d	1.6	3.3
Crude protein, % of DM	13.2	16.0
Fat corrected milk, kg/d	38.3	38.3
Fat, g/d	1448	1421
Protein, g/d	1107	1103

Source: Nakamura et al., 1992. J Dairy Sci 75 3519-3523

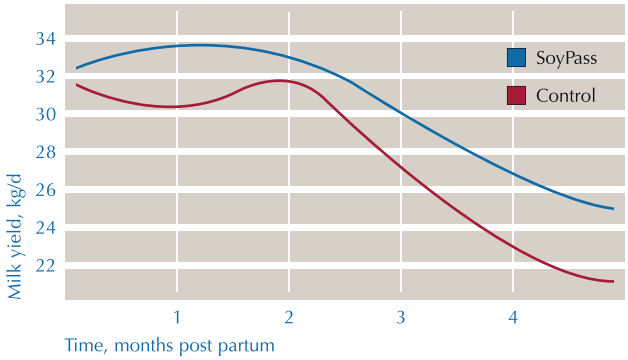
There was no difference in the fat corrected milk yield of the cows, averaging 38.3 kg/d, in response to the change from soyabean meal to SoyPass®, with the protein content of the ration decreased from 16% to 13%. This indicates that SoyPass® can perform as well as twice the quantity of soyabean meal, and thus the suggested replacement rate (usually 2/3rds the weight of soya) can be applied in the expectation that some milk yield benefit will also be seen.

SWITCHING SOYABEAN MEAL FOR SoyPass®

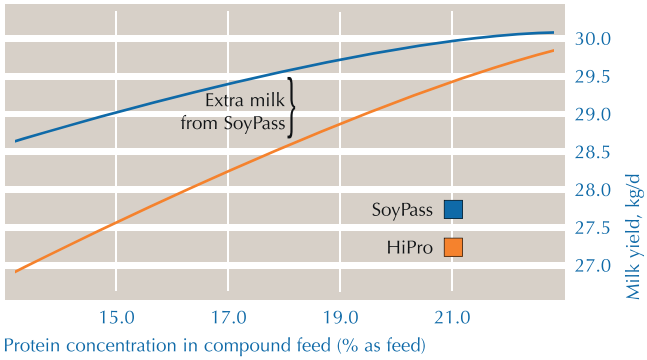
A trial was conducted in Europe, where soyabean meal (21% of concentrate) was replaced with SoyPass®. The two feeds were then fed, in conjunction with maize and grass silages, to a total of 77 freshly calved cows over the first 5 months of lactation. After the first 8 weeks of feeding, the amount of concentrate offered was changed to reflect the actual milk yield of the cows. The cows fed the SoyPass® diet produced an average of 1.4 kg/d of milk more than those fed the soyabean meal diet, over the 5 months of the experiment. Lactation appeared to be more persistent over this period, and the feed intake was also lower. Cows averaged 1.20 kg/d of soyabean meal or SoyPass® over the course of the experiment.

Work conducted at the Agricultural Institute of Northern Ireland used High Genetic merit cows, fed on a series on concentrate feeds, where SoyPass was directly replacing soyabean meal. Cows were offered ad libitum access to grass silage, with concentrates differing in crude protein content, and the level of degradability of that crude protein, in a complex experimental design. The difference in milk yield decreased as the crude protein concentration in the concentrate increased, but using an 18% cake equated to an increase of 0.88 kg of milk/d when SoyPass was included in the ration.

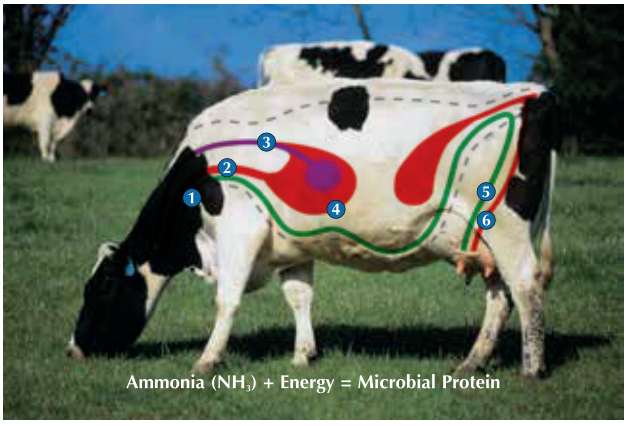
Milk yield over a 5 month feeding trail - benefit from replacing SBM with SoyPass® average increase in milk yeild 1.4kg/d



Milk yield from high genetic merit cows fed concentrates containing SoyPass® or soyabean meal



The role of SoyPass® in providing undegradable protein to the ruminant



1. Bypass protein
2. Degradable protein
3. NPN (Non Protein Nitrogen) in feed
4. Degradation of NPN and rumen degradable protein into NH_3
5. Intestinally digestible rumen undegradable feed protein
6. Intestinally digestible microbial protein

SoyPass®
IN OTHER APPLICATIONS

Growth studies at the University of Nebraska using SoyPass® for beef cattle, have shown a significant increase in weight gain compared with untreated soyabean meal. On feeding to sheep positive results in wool growth have also been reported.

SOYPASS® - FEATURES

SoyPass® is a consistent and economic source of undegradable protein. The method of production produces a product with a medium brown colour and a pleasant aroma as well as good palatability. The careful quality controls ensure a reliable level of by-pass protein, so that on average, more than 80% of the protein in SoyPass is rumen protected.

SOYPASS® HAS MANY ADVANTAGES OVER OTHER SOURCES OF BYPASS PROTEIN

- Uses well known, highly palatable, safe and natural raw materials
- High in crude protein and bypass protein
- Bypass protein levels are consistent and reliable
- Bypass protein from SoyPass® is highly digestible in the intestine
- Excellent amino acid profile of bypass protein
- Improves protein efficiency and reduces nitrogen excretion
- SoyPass® is a highly economic supplier of bypass protein

SOYPASS® typical analytical values - g/kg product (fresh)			
Dry matter	870	Ca	4.7
Crude protein	450	P	7.2
Oil	19	Na	0.2
Crude fibre	33	Mg	3.9
Ash	60	K	21.0
Starch	19	Cl	0.3
Sugars	90		

BYPASS VALUES OF SOME TYPICAL RUMINANT FEEDSTUFFS

Undegraded dietary protein (UDP) is the commonly used value for estimating the bypass value of a feed in all of the current feeding systems.

Digestibility was assessed by mobile bags or the Minnesota 3-Step method, and is taken from NRC (Nutrient Requirements of Dairy Cattle, 2001). Intestinally available protein is the product of crude protein concentration, UDP and digestibility, and represents the amount of crude protein which will be available for absorption by the cow (g/100g of original feedstuff dry matter).

Foodstuff				
Maize gluten meal	65.0	0.71	92	42.4
Fishmeal (menhaden)	68.5	0.64	90	39.2
SoyPass®	50.0	0.76	93	35.4
Extracted soyabean meal 48%	53.8	0.38	93	19.1
Linseed meal (extracted)	32.6	0.49	85	13.7
Extracted rapeseed meal	38.4	0.29	70	7.8
Whole cottonseed	23.0	0.38	80	7.1
Maize gluten feed	23.8	0.28	85	5.6
Sunflower seed meal	28.4	0.14	90	3.6
Wheat	14.2	0.24	95	3.2
Barley	12.4	0.21	85	2.3

Data taken from NRC 2001

Crude protein (% of DM)
UDP (% of CP at 6% outflow)
Digestibility (%)
Intestinally available protein

Benefits of Soypass®:

1- SoyPass® Improve feed efficiency.
2- SoyPass® Reduce the stress of ammonia on the liver and therefore improve fertility.
3- SoyPass® Improve milk production , health, fertility and growth rate.
4- SoyPass® Improve colostrum quality when used for close up cows.
5- SoyPass® Produced from environmentally friendly and natural raw materials.
6- SoyPass® is a cost effective supplement.

Recommended daily feed rates (per head)

Milking cows	Up to 2 kg .
Dry cow	Up to 0.5 kg .
Replacement heifers	Up to 0.5 kg .
Beef cattle	Up to 0.5 kg .
Calves	Up to 0.5 kg .
Ewes and Rams	Up to 0.25 kg .

Providing solutions..... it's in our nature

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