How a corn and yeast protein product can improve your bottom line

Dried distillers grains plus solubles (DDGS), a co-product from the dry mill ethanol process, has been utilised within dairy rations as a source of protein and energy for quite some time. Data has shown that feeding DDGS can be effective in increasing animal performance as well as an economical source of nutrients.

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Over the last couple of decades, bioprocessing facilities began utilising technologies to remove a portion of the oil during the production process which has allowed diversification of feed ingredients for both the dairy producer and bioprocessing facility alike.

As advancements in technology evolve, dry mill facilities have the opportunity to produce additional feed ingredients that can be tailored to better fit the needs across different livestock as well as marine species.

One technology available today, post-fermentation mechanical separation, utilises a patented process referred to as Maximised Stillage Co-Products (Fig. 1).

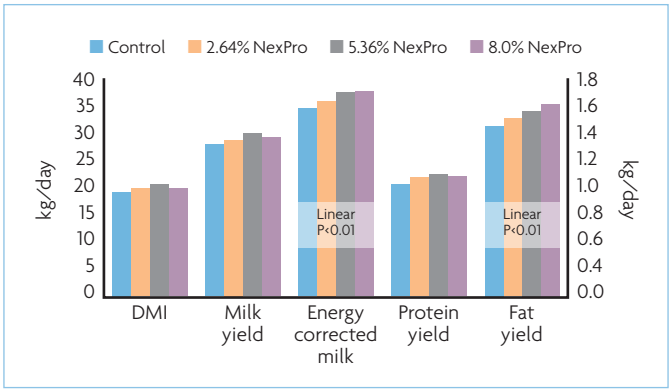


Fig. 2. Performance and composition of lactating dairy cows fed increasing inclusions of NexPro.

This technology is implemented after distillation where the whole stillage or remaining solids are transferred through a series of screens that physically dissociates the major nutrient components (protein, fat, and fibre).

Once separated into different product streams, the concentrated protein along with the yeast fractions are transferred to a separate ring dryer to yield the concentrated branded protein product, NexPro Protein Ingredient.

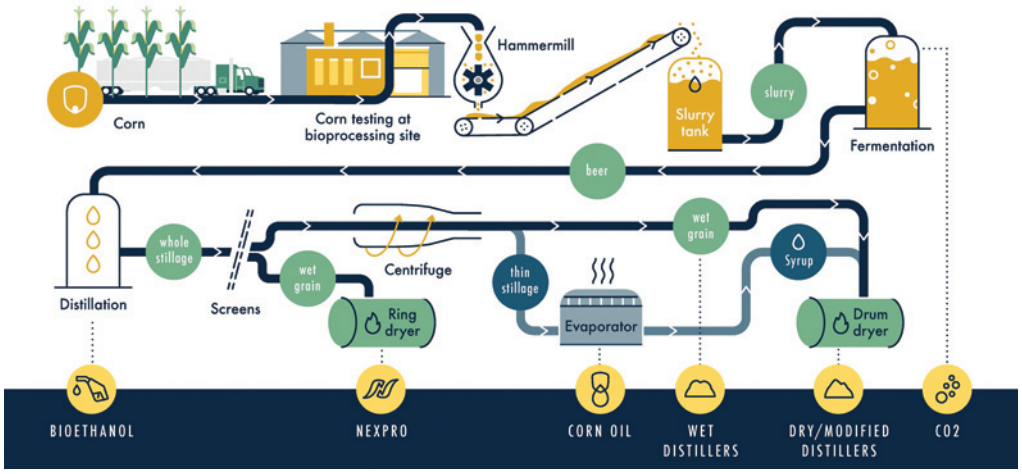
NexPro, 50% crude protein, contains more lysine than typical DDGS, more methionine than treated soy, and based on mannan derived ratios approximately 20-25% apparent inactivated yeast.

Conversely, due to the production process, a large proportion of the protein fraction of NexPro is undegraded within the rumen bypassing those amino acids to the small intestine where they are utilised for milk protein synthesis.

A physical differentiator of NexPro from typical DDGS is particle size. NexPro is comprised of significantly finer particles attributing to the potential increase in passage rate of the product from the rumen to the small intestine.

The combination of these characteristics makes NexPro a unique ingredient within the co-product space. There is no previous data demonstrating the response of NexPro within dairy diets. Therefore, a trial was conducted to evaluate NexPro replacing non-enzymatically browned soybean meal on milk production and nutrient digestibility in mid-lactation dairy cows.

Fig. 1. Diagram of the NexPro production process.



Research trial

The trial was designed as a triplicated 4x4 Latin square, utilising 12 lactating Jersey dairy cows (95 ± 7.5 DIM) with four 28-day periods. Cows were blocked by DIM and randomly assigned to diets.

Dietary treatments (Table 1) consisted of replacement of a non-enzymatically browned soybean meal with NexPro at titrating inclusions; 2.64%, 5.36%, and 8% (DM basis).

Measurements included nutrient characterisation, dry matter intake (DMI), milk and component yield, and nutrient digestibility by total collection.

Nutrient composition of NexPro samples are listed in Table 2. Crude protein (DM basis) was reported at 53.6% which is significantly greater than DDGS, approximately 30%. The amino acid profile, as a percentage of CP, was reported as 3.71% lysine, 2.5% methionine, 2.59% histidine, and 4.22% threonine.

The greater lysine and methionine concentrations are advantages to feeding NexPro as those two are often considered the most limiting within corn-based diets.

Continued on page 29

Ingredient	Control	8% NexPro
Corn silage	40.0	40.0
Alfalfa hay	18.1	18.1
Ground corn	14.3	14.3
NexPro[1]	-	8.00
Soybean meal	2.66	2.66
Non-enzymatically browned SBM	8.00	-
Soybean hulls	8.61	8.61
Urea	0.64	0.64
Salt white	0.38	0.38
Sodium bicarbonate	0.60	0.60
Vitamin premix[2]	0.04	0.04
Molasses beet	1.73	1.73
Fat supplement	3.00	3.00
Trace mineral premix[3]	0.05	0.05
Calcium carbonate	1.11	1.11
Calcium phosphate	0.51	0.51
Magnesium oxide	0.40	0.40
Chemical composition		
DM	59.6	59.4
CP (% DM)	16.14	16.06
Fatty acids	4.87	5.15
16C fatty acids	1.60	1.65
18C fatty acids	2.69	2.90
aNDFom[4,5] (% DM)	30.67	31.59
ADF	20.85	21.81
Lignin (% DM)	3.14	3.36
Ash (% DM)	7.54	7.25
Starch (% DM)	27.15	27.98

[1]NexPro, POET, Sioux Falls, SD. [2]Formulated to supply approximately 1,133.79 KIU/d vitamin A, 181.41 KIU/d vitamin D and 53.51 IU/d vitamin E in total rations. [3]Formulated to supply approximately 2,000mg/kg Co, 20,000mg/kg Cu, 2,000mg/kg I, 5mg/kg Fe, 100,000mg/kg Mn, 625mg/kg Se and 15mg/kg Zn in total rations.[4]Amylase-treated NDF on organic matter basis. [5]Van Soest et al. (1991) using α-amylase and sodium sulphite.

Table 1. Ingredient and diet chemical composition (% of diet DM).

Item	Mean	SD
% DM	92.1	2.57
CP	53.6	1.13
Sol. protein	4.52	0.818
NDCIP[2]	5.00	2.22
ADCIP[3]	3.73	1.463
aNDF[4]	31.2	3.53
ADF	19.2	2.43
Lignin	1.96	0.756
Sugar	1.25	0.391
Starch	1.47	0.276
Crude fat	5.81	0.461
Minerals		
Ash	3.47	0.373
Ca	0.03	0.012
P	0.72	0.155
S	0.71	0.097
Amino acids (% of CP)		
Lys	3.71	0.126
Met	2.50	0.087
Thr	4.22	0.096
His	2.59	0.078
RDP (% CP)[5]	14.3	1.13
RUP (% CP)[6]	85.7	1.14
RUP digestibility (% RUP)[6]	76.4	2.25
Total tract digestibility (% CP)	79.8	1.88

[1]Values determined by Cumberland Valley Analytical Service (Waynesborough, PA). [2]Neutral detergent-insoluble crude protein. [3]Acid detergent-insoluble crude protein. [4]Van Soest et al. (1991) with α-amylase and sodium sulphite. [5]RDP = Rumen degradable protein. [6]RUP = Rumen undegradable protein

Table 2. Chemical composition of NexPro (n=10).

Continued from page 27

Utilising the Multi-step In Vitro Evaluation (Cumberland Valley Analytical Services; Waynesboro, PA); RDP, RUP, and RUP digestibility were calculated at 14.3%, 85.7%, and 76.4%, respectively. The available RUP within NexPro is similar to or greater than other commercially available RUP sources making it a competitive alternative.

Cow performance data are listed in Fig. 2. No differences in DMI were observed across the four treatments, however, performance results were positive for the diets containing NexPro. Cows fed the NexPro diets, on average, produced approximately 4% more milk and 7% greater energy corrected milk compared to the control diet without NexPro.

Similarly, cows fed NexPro treatments, on average, yielded 6% and 8% more milk protein and fat, respectively.

The protein response could be the result of additional available methionine within the RUP fraction.

Fat within NexPro, lower than conventional DDGS, appears to be bound within the remaining fractions of the product thus potentially diverting biohydrogenation, or the increased yeast concentration could be stimulating fibre digesting bacteria in the rumen and producing a more favourable volatile fatty acid ratio.

Regardless, this is a response that has not been observed with feeding a dry mill co-product previously. No differences in body weights or body condition score (data not reported) were observed by treatment suggesting that cows were not mobilising body reserves to compensate for the increase in milk fat.

Lastly, apparent total tract digestibility of nutrients are reported in Table 3. No differences were observed for dry matter, NDF, CP, starch, and total fatty acids digestibilities regardless of treatment. However, a slight quadratic response for organic matter digestibility was reported.

Although we did not observe digestibility differences within this trial, additional research has been conducted that would support improvements in digestibility.

Conclusions and applications

Overall, cows in mid-lactation responded quite favourably to diets with NexPro replacing non-enzymatically browned SBM.

With minimal impacts on digestibility, increases in milk yield and milk components can be obtained with feeding 5-8% NexPro within corn silage based dairy diets.

Bringing in a new feed ingredient to provide additional methionine and energy could be what your cows need to reach the next level of production and increase your bottom line. ■

Table 3. Apparent total-tract digestibility of nutrients of lactating Jersey cows fed increasing inclusion of a novel high protein corn milling co-product.

Item	Treatments				SEM	P-value[1]		
	Control	2.6% NexPro	5.4% NexPro	8% NexPro		L	Q	C
DM (%)	66.4	67.1	67.0	65.8	0.63	0.45	0.12	0.89
OM (%)	68.4	69.0	68.8	66.9	0.65	0.08	0.05	0.78
NDF (%)	47.9	50.1	48.5	48.4	2.14	0.99	0.22	0.21
CP (%)	66.2	66.4	66.9	65.0	0.79	0.35	0.16	0.38
Starch (%)	95.8	95.4	95.8	94.2	0.96	0.18	0.38	0.37
Total fatty acids (%)	73.0	73.6	75.2	74.7	2.56	0.38	0.98	0.38

[1]L = Linear, Q = Quadratic, C = Cubic