




Animals in Science



The advancement of plant extracts as performance enhancers in ruminants and monogastrics was evident at two recent international animal science conventions. In total, 18 papers and posters were presented jointly by Pancosma and research partner ADM Animal Nutrition at the Poultry Science Association (PSA) and the joint American Society of Animal Science (ASAS) and American Dairy Science Association (ADSA) annual meetings.

Along the pipeline of extract-based performance enhancers coming to market, presentations covered the spectrum from recently launched products to blue-sky exploration of possibilities.

Milk yield increase of 1.09kg/cow/day found across 16-trial meta-analysis

 In support of a product already in use on dairy farms in a number of countries, a new meta-analysis¹ covering 16 separate trials was presented on the impact of two naturally occurring plant extracts used in combination in dairy cow diets. Across all trials, milk yield was increased by 1.09kg/cow/day, with corresponding uplifts in yield of protein and fat of 3.2% and 4.3% respectively, by the eugenol-cinnamaldehyde combination.

The significance of this for the animal feed industry should not be underestimated in the glare of new political light on the issue of global food supplies and food security. Looking at China alone, Prime Minister Wen Jiabao has been quoted as saying “I have a dream to provide all Chinese, especially our children, with half a litre of milk a day”.²

In 2003, average daily per capita milk consumption in China was 15.3ml,³ so an additional 485ml/day for 1.2 billion people amounts to about 190 million tonnes of milk over a year. In comparison to this, the extra 1.09kg/cow/day identified by the meta-analysis applied hypothetically to the entire global population of 225 million dairy cows would amount to 80 million tonnes/year of additional production, or less than half the Chinese Prime Minister’s aspiration.⁴

In combination with higher milk yield, feed intake was found by the meta-analysis to be increased by an average 1.56kg DM/cow/day. At a likely energy density of 12MJ/kg DM, this would result in 18.8MJ/day of additional energy intake and, if this was converted entirely into milk, the additional production would be about 3.5kg/cow/day, or around two litres more than was found.

A likely explanation, according to Pancosma Head of R&D Dr David Bravo, is that about 10MJ of the additional intake is possibly being partitioned to body reserves, reducing weight loss then increasing weight gain in early and mid-late lactation respectively. “*In high yielding herds where negative energy balance in early lactation has a detrimental bearing on cow fertility, this effect could have a marked impact,*” he says. “*Then in later lactation, it could allow diet specification and therefore cost to be reduced while maintaining cows’ body condition at the target level for drying off.*”

In the proprietary product, **XTRACT Dairy 6965**, the two active ingredients are micro-encapsulated with hydrogenated vegetable oil. This controlled-release formulation creates a much longer dwell-time, and therefore duration of activity, in the rumen compared with liquid presentation. The recommended daily feed rate is 1500mg per cow.




Pancosma, Head of R&D, Dr David Bravo presented several papers at the ASAS/ADSA meeting in Indianapolis, USA, July 2008.

Reference

- 1 Dr David Bravo* and Dr Perry Doane**, November 2007. Meta-analysis of the effect of **XTRACT 6965** in dairy cows. Pancosma Research Report No 3. (*R&D Pancosma, **R&D ADM Alliance Nutrition Inc).
- 2 Kingshay News, April 2008. The China Effect On Your Profit. Members’ newsletter of The Kingshay Farming Trust, Glastonbury, UK.
- 3 Iowa Ag Review Online, Summer 2004 (vol 10, no 3). China’s Growing Market for Dairy Products. Center for Agricultural and Rural Development, Iowa State University, USA.
- 4 1.09kg/cow/day x 225,000,000 cows x 365 days x 89%*** = 79.7 million tonnes per year (***) assumes average cow spends 500 days in milk then 60 days dry, therefore average percentage of cows in milk at any one time is 500/560 = 89%.

Better beef performance from plant extract supplements

 The capsicum extract, capsaicin, has been found to increase feed intake in beef animals on a high concentrate diet by 9.9% in a trial reported at ASAS.⁵ At the feed rate of 0.25g/head/day of the extract, concentrate intake was 8.4kg/head compared to 7.64kg of a negative control. The same trial found a 7.3% increase in water consumption attributed to the extract, and no effect on rumen pH or ammonia level.

Another ASAS paper identified that supplementing a high concentrate beef diet with 0.5g/head/day of capsicum extract increased eating time to 11.3% from 8.0% on a negative control.⁶ The daily depression of rumen pH was also found to be less on the trial diet.

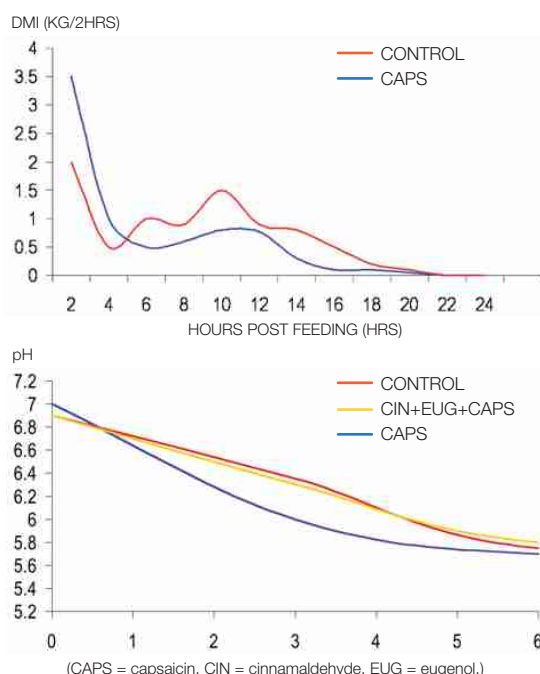
These results replicate another Pancosma trial (not presented at ASAS), in which capsaicin was also found to modify the distribution of feed consumption over the course of a day.⁷ It reduced the size of the first meal after fresh feed was offered and increased consumption at visits to the feed trough later in the day (see Figure 1). One advantage of this is reduced acidosis resulting from the first big feed of the day.

Returning to ASAS papers, one more from Pancosma demonstrated parity in animal performance between high concentrate diets supplemented with monensin or XTRACT 7065 for beef (see Table 1), both supplied at recommended levels.⁸ One notable difference was that rumen ammonia levels were markedly lower on the plant extract treatment. This is possibly due to lower rumen pH that is conducive to reduced protein degradation, in combination with an effect of the plant extracts used in this trial on specific deaminative bacteria in the rumen, according to Dr Bravo.

Table 1: Comparison of beef cattle performance and behaviour on high concentrate diets supplemented with either monensin or XTRACT 7065 for beef.

	Monensin (430mg/kg DM Rumensin®)	XTRACT 7065 (800mg/head/day)
Dry matter intake (kg)	6.45	6.50
Average daily gain (kg)	1.23	1.31
Feed conversion ratio	4.99	4.96
Rate of subcutaneous fat deposition (mm/month)	1.68	1.80
No of daily visits to feeder	10.74	11.2
Average time per feeding visit (min)	9.72	9.55
Rumen pH	6.09	5.58
Rumen ammonia (mg/dl)	20.05	10.78


Figure 1: Impact of capsaicin on feed intake over 24 hours (top) and rumen pH (bottom) compared with negative control.



Reference

- Dr David Bravo et al (2008). Effects of the dose of capsicum extract on intake, water consumption and rumen fermentation of beef heifers fed a high concentrate diet. ASAS/ADSA abstract, Indianapolis, USA.
- Dr David Bravo et al (2008). Effects of cinnamaldehyde-eugenol and capsicum on rumen fermentation and feeding behaviour in beef heifers fed a high concentrate diet. ASAS/ADSA abstract, Indianapolis, USA.
- Dr David Bravo* and Dr Sergio Calsamiglia***, (2007). The effect of capsicum and a mixture of eugenol and cinnamaldehyde on rumen fermentation in beef heifers fed a high concentrate diet. Pancosma Research Report no 7. (*R&D Pancosma, **University of Barcelona).
- Dr David Bravo et al (2008). Effects of essential oils on ruminal environment and performance of feedlot calves. ASAS/ADSA abstract, Indianapolis, USA.

Round-up of other ASAS papers

 After 21 days on trial, piglets supplemented with a crystalline iron glycinate (B-TRAXIM® 2C Fe) had 15.5% higher haemoglobin, 12.3% higher haematocrit and 5.1% higher red blood cell counts than trial mates supplemented with iron sulphate.⁹ Higher readings were also present after 42 days. Both supplements supplied an iron level of 100mg/kg DM.

Two papers presented validation data for Pancosma-developed in vitro models of the jejunum-ileal ecosystem of veal calves and ileal digestion in pigs.¹⁰ Another showed evidence of the sustained release characteristics of plant extract pellets produced by fluidised bed technology developed by Pancosma and employed in the company's manufacturing processes.


In pigs, a poster presentation of a study with the University of Barcelona showed intestinal antimicrobial activity at doses similar to formic acid from the plant extracts carvacrol, cinnamaldehyde and capsicum oleoresin in **XTRACT** 6930. The effect was particularly marked in the jejunum.

In addition, the supplement's microencapsulated physical form creates a prolonged, sustained and optimised release of the bioactive compounds into the digestive tract. This is important to control their biopharmaceutical behaviour and achieve optimum effect, explained Production Technology Manager Dr Jean-Philippe Meunier. Abstracts of all papers are available from your usual contact person at Pancosma.



Pancosma Production Technology Manager, Dr Jean-Philippe Meunier presented an in vitro model to simulate the porcine ileal digestion of diets differing in carbohydrate composition.

Coming of age for plant extracts as broiler performance enhancers

 In a meta-analysis of 13 different trials presented to the Poultry Science Association, broiler growth rates were increased by 4.9%, feed intake was 2.7% higher, and feed conversion 2.9% better, on diets supplemented with a combination of carvacrol, cinnamaldehyde and capsicum plant extract compared to negative controls (see **Table 2**).¹¹

The meta-analysis found parity between the extracts and positive (avilamycin-supplemented) controls. It also identified that on corn-based diets, the main effect of extracts was on growth rates, while on wheat-based diets, it was to improve feed conversion.

For the first time ever, one of the Pancosma papers documented the immunological basis of health-promoting effects of plant extracts such as cinnamaldehyde, capsicum, shiitake and curcuma in poultry. From the United States Department of Agriculture (Beltsville), Dr Hyun S. Lillehoj explained that the plant extracts on test had stimulated lymphocyte proliferation and innate immunity, and had inhibited tumour cell growth, compared to control treatments. She said this underlined the potential of such phyto-nutrients to offer alternative methods of disease control in poultry production.



The USDA's Dr Hyun S. Lillehoj underlines the potential of plant extract phyto-nutrients.

Table 2: Comparison of broiler chicken performance in 13 trials on diets supplemented with a three-component plant extract supplement with negative and positive control diets.

	Negative control (NC)	3-way plant extract combination (diff of NC)	Positive (avilamycin) control
Feed intake (g/d)	81.9	84.1 (+2.7%)	84.0
Average daily gain (g/day)	48.9	51.3 (+4.9%)	50.4
FCR	1.73	1.68 (-2.9%)	1.71


Reference

- ⁹ Stéphane Durosoy et al (2008). Iron status evolution of weaned piglets fed iron sulphate or iron glycinate. ASAS/ADSA abstract, Indianapolis, USA.
- ¹⁰ (i) Dr David Bravo et al (2008). Validation of a continuous in-vitro system modelling the jejunum-ileal ecosystem of veal calves. ASAS/ADSA abstract, Indianapolis, USA. (ii) Dr Jean-Philippe Meunier et al (2008). Evaluation of a dynamic in-vitro model to simulate the porcine ileal digestion of diets differing in the carbohydrate composition. ASAS/ADSA abstract, Indianapolis, USA
- ¹¹ Dr David Bravo and Catherine Ionescu (2008). Meta-analysis of the effect of a mixture of carvacrol, cinnamaldehyde and capsicum oleoresin in broilers. PSA, Niagara Falls, Canada.

Early indications of potential from new plant extract sources



Pancosma R&D Engineer, Catherine Ionescu, presented five papers at the PSA Symposium held in Niagra Falls, Canada, July 2008.


 Among the papers presented at the PSA by Pancosma, seven featured early indications of the potential of mushrooms as sources of plant extracts with performance enhancing potential in chickens.¹² It is important to emphasise that research and development in this area is in its early stages and that the launch of fully tested and dependable feed supplements are not imminent.

Results so far suggest that microbial populations in the chicken gut, and intestinal health, may be modified

by some mushroom extracts. For example, a trial in which chickens were subject to necrotic enteritis found mortality of 39% in the control (infected, not treated) group, and in the range 20 to 30% in groups treated with two mushroom extracts either singly or in combination.

Four of the papers also explored the potential of mushroom-derived supplements in the future control and management of coccidiosis.

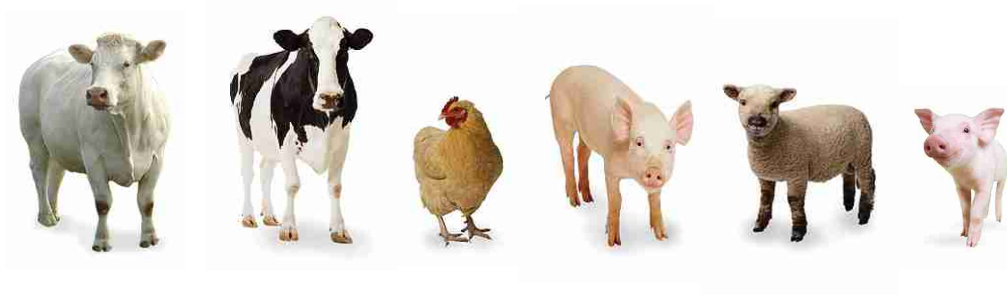
Transformation from “herbal remedy” to consistent, dependable and science-based technology

 The plethora of papers presented by Pancosma at ASAS/ADSA and PSA is the latest step in consolidating plant extracts as dependable science-based performance-enhancers, according to the company’s Marketing Director, Gavin Raper. He says an essential component of introducing new products to the market is employing rigorous scientific methodology during their development.

“In the early days of introducing plant-based feed supplements, the development of some products may have owed more to herbalism than science,” he says. “Today though, plant extract-based performance enhancers are researched and developed by this company with the same precision and scientific rigour as amino acid supplementation.”

Reference

¹² Details and abstracts available from Pancosma.



Keep up to date with all the latest information at
www.pancosma.com