RFC technology tackles pathogens while enhancing poultry productivity

by Dr Sangita Jalukar, Product Development and Research Coordinator, Arm & Hammer Animal Nutrition

Setting your flock up for success is a key management focus – no matter where you are located. That means following proper facility and feeding hygiene, and enhancing health so that animals can more easily fight off infections from contact with harmful pathogens. Nutritional solutions like Refined Functional Carbohydrates™ (RFC™) offer producers an exciting option to enhance animal health and productivity with a single feed ingredient.

WHAT ARE RFCS?

RFCs feature technology that can help provide a healthy foundation for poultry while delivering the nutrition they need. RFCs are the components harvested from yeast cells (*S. cerevisiae*) using specific enzymes during the manufacturing process. This enzymatic hydrolysis yields:

- MOS (Mannan Oligosaccharides)
- Beta 1,3-1,6 glucans
- D-Mannose

These compounds are naturally present in all yeast cells, but are not readily bioavailable. The method of processing used to refine the yeast cells influences the size and structure of these liberated components, which, in turn, affects bioavailability and functionality. Research shows that each RFC has a specific mode of action and outcome when fed to poultry and livestock.

WHAT DO RFCS DO?

RFCs can help maintain overall animal health – directly and indirectly. Health and production challenges can occur at any time. Adding RFCs to an animal's diet from an early age can help improve its immune function – indirectly by preparing it for challenges and directly by providing a defence mechanism against pathogenic bacteria.

HOW RFCS WORK

The RFCs bind to the receptors of certain protozoa, for instance, *Cryptosporidium* and *Eimeria* and prevent them from attaching to the intestinal wall and causing disease. Likewise, RFCs help prevent bacteria from colonising within the animal's body, like *Salmonella* in the caeca of poultry, for instance.

In a recent study, of the caeca sampled from breeder hens fed the control diet, 71.4% were found to contain *Salmonella*, while none of the caeca from the hens fed the RFC diet tested positive for *Salmonella* (Fig. 1).

Further, when broiler progeny of these birds were fed a diet that included RFCs, their caeca also contained no evidence of *Salmonella*. However, 12.5% of broiler progeny caeca contained *Salmonella* when not fed a diet containing RFCs (Fig. 2).

Fig. 1. Prevalence of Salmonella in caeca of breeder hens.

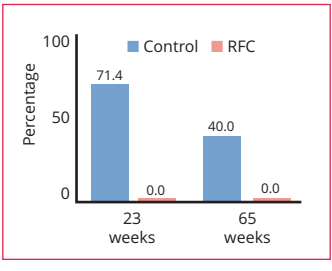
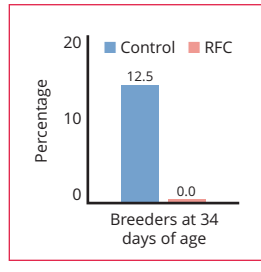


Fig. 2. Broiler progeny of control versus RFC fed breeders.



References for all research cited available on request

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Boost egg production efficiency with RFCs

by Dr Sangita Jalukar, Product Development and Research Coordinator, Arm & Hammer Animal Nutrition

Refined Functional Carbohydrates™ (RFC™) are the components harvested from yeast cells (*S. cerevisiae*) using specific enzymes during the manufacturing process. They are a unique feed additive designed to improve overall health, growth and feed conversion in poultry. Multiple studies with broilers show these benefits to be consistent for those birds.

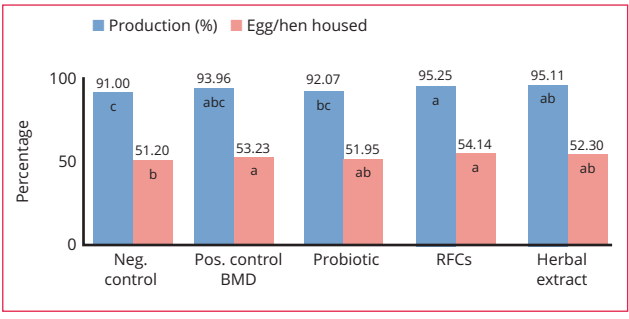
Researchers recently set out to determine if RFCs can offer the same efficiency benefits for layers as has been shown in broilers, and how well it compared to some other common feed additives. During the study, which was conducted in Guatemala and featured 200 Lohmann White Classic layers at 28 weeks of age, the birds were given a two-week adaptation period that was followed by eight weeks of data collection. A basal layer diet was formulated to meet the strain of egg-type chicken used. Water via two nipple drinkers per cage and mash feed prepared at a commercial feed mill was provided.

RESEARCH RESULTS

As presented at the 2016 International Poultry Science Forum, data showed that RFC results were excellent compared to some of its competitors. RFCs were very good at improving both egg production efficiency as well as improving some of the egg parameters, supporting its application in the layer industry very well, for example:

- All treatments improved egg production compared to control, but RFCs gave the largest numerical improvement in percent production and number of eggs/hen housed compared to other feed additives tested (Fig. 1).

Fig. 1. Egg production.



In addition, results in Table 1 also showed:

- Egg weight was not affected by treatments.
- Egg yolk colour and Haugh units were significantly higher in hens supplemented with an antibiotic, RFCs and herbal extract compared to control and probiotic.
- Egg shell thickness was highest in hens receiving an herbal extract and lowest in those receiving the probiotic, with all other treatments being intermediate.

The researchers concluded that RFCs fed to layers resulted in the largest improvement in layer performance while improving some egg parameters compared to other feed additives tested.

Table 1. Effect of treatments on egg parameters.

Variable	Neg. control	Pos. control BMD	Probiotic	RFCs	Herbal extract
Birds (No.)	40	40	40	40	39
Egg weight (g)	59.01	59.15	58.68	60.12	60.61
Yolk colour (RCF)	10.43^{b}	11.41^{a}	10.75^{b}	11.38^{a}	11.45^{a}
Haugh units	92.18^{b}	96.36^{a}	95.48^{ab}	97.18^{a}	96.87^{a}
Shell thickness (µm)	364.79^{ab}	365.66^{ab}	357.53^{b}	367.07^{ab}	374.78^{a}

^{a,b,ab} signify significant difference (P<0.05)

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Reduce the effects of coccidiosis

by Dr Sangita Jalukar, Product Development and Research Coordinator,
Arm & Hammer Animal Nutrition

With an estimated annual global impact of 3 billion (USD) in chickens alone, it is no wonder poultry producers focus on controlling coccidiosis. The disease is caused by a protozoan-parasite called *Eimeria* – of which there are a number of host-specific species that live and multiply in a bird's intestinal tract, causing tissue damage.

This damage can interfere with food digestion and nutrient absorption, as well as causing dehydration and blood loss. The tissue damage can also expose the bird to bacterial infections, like *Clostridium* and *Salmonella*.

Disease impact on bird health can range from mild to severe, depending on the species of coccidia involved. However, often the disease is subclinical and birds may only show poor weight gain or feed conversion rates at the end of grow-out.

RFCS CAN HELP

Through our research, we have learned that the Refined Functional Carbohydrates (RFC) in CELMANAX™ (marketed as AVIATOR™ in certain international markets) act in synergy against several gastrointestinal challenges to consistently help improve broiler performance.

For instance, in vitro studies show that RFCs reduced the attachment of *Cryptosporidium parvum* (same class of protozoa as *Eimeria*) to epithelial cells. Similarly, RFCs can lower the ability of *Eimeria* sporozoites to attach to intestinal epithelial cells. This means reduced intestinal lesions and more oocysts recycling to maintain immune development.

This ability was examined in a trial in which RFC supplementation was compared to coccidiostat supplementation from 1-21 days of age in broilers given a moderate coccidiosis challenge with *E. maxima*, *E. acervulina* and *E. tenella* at 15 days of age. Results demonstrate that RFCs were very effective in reducing *E. tenella* lesions and moderately effective against *E. maxima* and *E. acervulina* in this short experiment.

RFC EFFECTS ON PERFORMANCE

Additional research shows that under standard commercial coccidiosis control programs using vaccination or coccidiostat supplementation, including RFCs in broiler diets improved body weight and feed conversion rate at 42 days of age. This effect of RFCs in coccidiosis management allows coccidiostat withdrawal after 16 days of age from the broiler diets without sacrificing body weight gain or feed conversion rate when RFCs were supplemented in all diet phases.

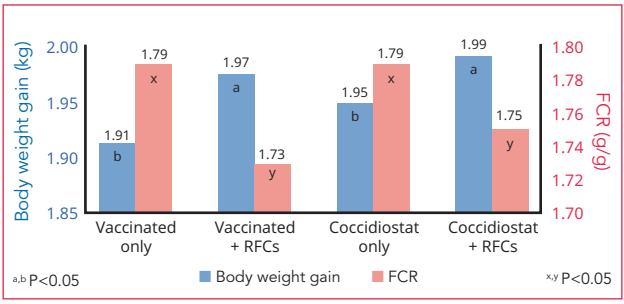

Fig. 1. Effect of RFCs on body weight of broilers and FCR at 42 days of age.

These experiments demonstrate that RFCs consistently help improve performance in both normal and challenged conditions. Therefore, not only do RFCs improve poultry health, they also often result in financial benefits due to improved flock productivity.

References for all research cited is available on request

Stop by the Arm & Hammer Animal Nutrition booth at EuroTier, Hall 18, Stand B09, to meet the team

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RFCs reduce degree of *Salmonella* infection in commercial layers

by Sangita Jalukar,
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Researchers recently determined that the Refined Functional Carbohydrates (RFCs) in Celmanax can reduce the load of *Salmonella* in challenged layer pullets by more than one log (P=0.056).

TRIAL DETAILS

The trial set out to determine if feeding Celmanax to commercial layer pullets either from day one to 17 weeks or from 10 to 17 weeks would affect *Salmonella enteritidis* colonisation of both the digestive tract (caecum) and ovaries. During the research, each bird was in an individual cage, with 48 pullets per treatment group. The following treatments were tested:

• Treatment 1: No additive, challenge.

• Treatment 2: Celmanax, 100g/MT supplemented from day one to study termination, challenge.

• Treatment 3: Celmanax, 100g/MT supplemented from week 10 to study termination, challenge.

• Treatment 4: No additive, no challenge.

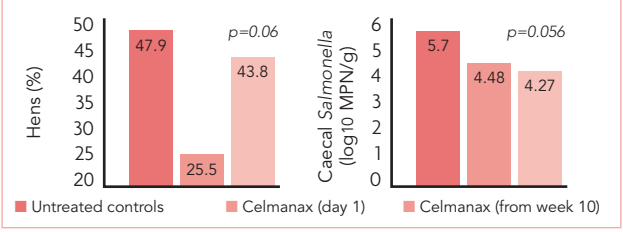
All birds were fed a non-medicated commercial layer diet in mash form. At 16 weeks of age the birds in treatments one, two and three were challenged with *S. enteritidis* (1.8×10^9 CFU/ml). One week post-challenge all birds were tested for the presence of *S. enteritidis*.

SALMONELLA REDUCTION RESULTS

Salmonella was identified in all the caeca and ovary samples from all three of the challenged treatment groups. However, Celmanax supplementation from day one of age tended to reduce the number of hens with high (over one million CFU/g) caecal *S. enteritidis* compared to untreated or Celmanax supplementation from 10 weeks of age (P=0.06) (Fig. 1a).

In addition, both Celmanax supplementation treatments reduced *S. enteritidis* by more than one log compared to untreated control (*P*=0.056) (Fig. 1b). There was no significant difference between challenged treatment groups with respect to ovary *Salmonella* prevalence. The researchers conclude that while Celmanax did not reduce colonisation of *S. enteritidis* in the ovaries, it reduced the degree of *S. enteritidis* infection in layer pullets when Celmanax was fed from day one. Therefore, to maximise effectiveness, include Celmanax in poultry diets early.

Fig. 1a. Left, Celmanax reduced prevalence of caecal *Salmonella* above one million cfu/g. Fig. 1b. Right, Celmanax reduced *Salmonella* log10 MPN per gram in caeca samples by 1.2 log.



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More evidence that RFCs reduce *Salmonella*

by Sangita Jalukar,
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Arm & Hammer Animal Nutrition

While Salmonella is not directly lethal to birds, occurrence is an important consideration for the industry since this pathogen, and resulting Salmonellosis, has been a public health concern for more than a century – and continues to be a major foodborne pathogen affecting people.

Recent independent studies evaluated the effect of the Refined Functional Carbohydrates (RFCs) in broiler breeder and broiler diets on Salmonella prevalence. The results indicate that RFCs offer opportunities to help reduce Salmonella levels in the food production chain.

• In the first study, broiler progeny from hens fed the control diet and receiving control broiler diets had 12.5% prevalence of Salmonella in the caeca. Broilers from RFC-fed hens and receiving 0 or 50g/MT of RFCs in the broiler diets had zero prevalence of Salmonella when samples were taken at day 34.

Table 1. Prevalence of *Salmonella* in caeca of broiler progeny of control fed breeders vs. RFC fed breeders.

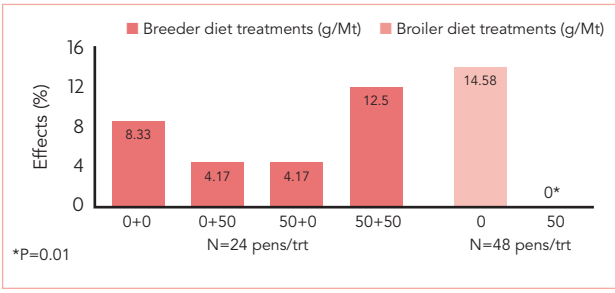
CONTROL	RFC
12.5%	0.00%

Broilers at 34 Days of Age

• In the second study, breeder hens and their broiler progeny were fed ±RFCs and Salmonella was monitored. Salmonella was detected in litter of breeder hens regardless of treatment with no significant difference within treatments. However, a strong treatment effect was observed for litter Salmonella prevalence in the broiler progeny from these breeder hens.

This research showed that supplementation of RFCs in the broiler diets reduced the prevalence of Salmonella in the litter. Salmonella prevalence was 14.58% compared to 0% in the RFC supplemented broilers (P=0.01). Salmonella was isolated in the caeca of broilers fed control diets and its prevalence was not affected by the breeder treatments. In contrast, Salmonella was not isolated in the caeca of broilers fed RFC-diets regardless of the breeder treatments. Breeder performance was not affected by treatments. RFC-fed female broilers had a tendency for improved body weight and feed-conversion ratio.

Fig. 1. Treatment effects on incidence of *Salmonella* presence in litter (%).



RFCS ARE EFFECTIVE

From these results, you can draw several conclusions, including:
• RFC supplementation in breeder diets decreased prevalence of Salmonella in the caeca of breeder hens, but did not eliminate Salmonella from the litter.
• RFC supplementation in the broiler diets reduced Salmonella prevalence in the litter and in the caeca compared to control-fed broilers.

Ultimately, these data show that RFC supplementation in the broiler breeder and broiler diets significantly reduced prevalence of Salmonella in the litter and caeca, thus supporting its benefit in a multifactorial Salmonella mitigation strategy in poultry production.

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Healthier birds equals improved performance

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The Refined Functional Carbohydrates™ (RFCs) found in CELMANAX™ have many benefits, not the least of which is helping to improve bird health. In turn, healthier birds are more efficient at converting feed into gain.

As you may recall, RFCs are the components harvested from yeast cell walls (*S. cerevisiae*) using specific enzymes during a proprietary manufacturing process. This enzymatic hydrolysis yields MOS (Mannan Oligosaccharides), Beta 1.3-1.6 glucans and D-Mannose – all of which are readily bioavailable in CELMANAX due to this proprietary process.

TURKEY RESULTS

A recent trial examined the effects of CELMANAX SCP on turkey poult performance when they were placed in stressful production environments. During the trial, 204-day-old male turkey poults were distributed in completely randomised replicated pens/treatments.

Treatments included:
- Control (no supplementation).
- CELMANAX SCP (100g/MT) fed continuously.
- CELMANAX SCP (200g/MT) fed only during first week of placement and for a week encompassing each period of transport stress.
- All poults were transported at weeks six, 12 and 16 to mimic industry practice. During weeks of transport, on alternate days, birds were exposed to an environmental challenge of *E. coli* to emulate field conditions.

After analysing the data, researchers found that continuous and intermittent feeding of CELMANAX SCP improved feed efficiency (FE) by 21 and 36 points, respectively; the intermittent feeding significantly improved FE (P=0.01) as shown in Fig. 1.

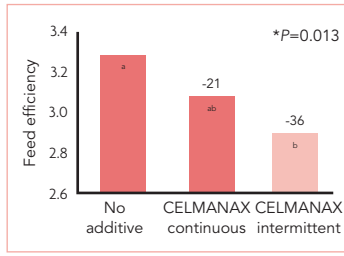

Fig. 1. Effect on feed efficiency (^{a,b} superscripts differing indicate significant difference (P<0.05)).

One point to note. In North America, feed efficiency is calculated by dividing feed intake by weight gain. The lower the number, the more efficient the flock in using the feed supplied. In some European countries, feed efficiency is calculated as weight gain divided by feed intake. In that instance, higher numbers represent a more efficient feed conversion. Results shown here reflect North American feed efficiency values.

OVERCOMING BROILER CHALLENGES

Additional trials explored how Celmanax helped broilers improve performance in the face of health and environmental challenges, as well. In this instance, the researchers examined the effects of clean water, mycotoxins and coccidia, as well as Celmanax SCP (50g/MT), on broilers. The basal diet contained on average 50ppb aflatoxin, 0.4ppm DON and 2.7ppm fumonisin, and treatments included new or used litter, clean or unchanged water and diets that did or did not include a coccidiostat.

Researchers found that:
- The study demonstrated the capacity of Celmanax SCP to maintain feed efficiencies in the absence of a coccidiostat in the grower and finisher phase.
- In the presence of water, litter, mycotoxin and coccidia challenges, Celmanax SCP improved the feed conversion ratio at 35 and 49 days.
- Under these challenge conditions, the addition of Celmanax SCP to diets in all three broiler growth phases was found to support optimal performance.

References available on request

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