Probiotics and field experiences in poultry

by Chin How Cheong, Lallemand, Singapore.

With the ban of antimicrobial growth promoters (AGP) in the EU since January 2006, there has been an increased use of organic acids, etheric oils, herbs, enzyme, prebiotics and probiotics as an alternative to AGPs in livestock and poultry feeding in European countries and other part of the world.

The benefits of probiotics used in livestock and poultry have been recognised for over 100 years but the results were mixed, inconsistent and, at times, controversial.

The effect of probiotics on gut health and benefits in poultry application is now well documented with the use of modern microbiological and molecular techniques and standardised experimental protocol.

Probiotics are used in poultry on the basis of demonstrated growth improvement parameters and maintenance of balanced gut health through water or feed application.

Probiotics for poultry

Fuller (1989) defines the term probiotics as 'a live microbial feed supplement which beneficially affects the host animals by improving its intestinal microbial balance'.

Recent new definition of probiotics from WHO/FAO (2002) is 'probiotics are mono or mixed cultures of live organisms, which, when administered in adequate amounts, confer a health benefit on the host'.

Table 1. Classification of EU authorised probiotic organisms (*specific strains).

Micro-organism*	Spore formation	Acid formation
Yeast		
Saccharomyces cerevisiae	–	–
Bacteria		
Bacillus	+	–
Bacteria		
Enterococcus	–	+
Lactobacillus	–	+
Pediococcus	–	+
Streptococcus	–	+
Fungi		
Kluryveromyces	+	–

In the US, the term 'direct-fed microbials (DFM)' is often used and the Food and Drug Administration (FDA) defines DFM as a 'source of live (viable) naturally occurring micro-organisms'.

Today there are more than 20 known species of micro-organism from bacteria, yeast or fungi available commercially as probiotics for poultry application worldwide.

The general characteristics and type of micro-organisms commonly used are presented in Table 1.

However, Thornton's (2010) global survey showed a low response to gut microflora technology application in poultry production with 30% and 28% in competitive exclusion cultures and direct-fed microbials respectively.

Treatment	Bird no.	Livability (%)	FCR	ABW (kg)	Feed cost (US$/kg)	Margin/ bird (US$)
AGP	3800	97.74	2.229	1.21	0.5088	0.9563
AGP + S. cerevisiae boulardii CNCM I-1079	4500	96.73	2.129	1.21	0.5155	0.9920
AGP + S. cerevisiae	4400	97.20	2.120	1.15	0.5152	0.9504

Table 2. AGP and AGP plus yeast probiotics effect on performance of coloured broilers. Rearing period 1-49 days. Selling price $US1.92/kg.

Mode of action of probiotics

The presence of a wide range of factors associated with feed, infectious disease agents, extreme environmental conditions and bad management practices can negatively affect the delicate balance of digestive gut flora and subsequently impair growth rate, FCR and livability of the bird.

The primary mode of action of probiotics is in maintaining positive intestinal microflora in the gut through effective modulation of intestinal microflora, toxin neutralisation and pathogen inhibition.

This is achieved mainly by modification of the gut pH with positive lactic acid bacterial population and antimicrobial effects by secretion of products like bacteriocins or SCFA (short chain fatty acids). There is additional digestibility and nutrient metabolism improvement through increasing digestive enzyme and degradation of unfavourable substances into digestible components with reduction in intestinal viscosity. The positive colonising effect of probiotics with lower gut pH exerts 'competitive exclusion' effect on potential pathogenic bacteria like salmonella, E. coli and clostridium in the gut.

Some probiotics, especially from yeast origin (for example the outer membrane of Saccharomyces cerevisiae boulardii is rich in mannose) will permit the binding of pathogenic bacteria that contain Type 1 fimbra.

Saccharomyces cerevisiae boulardii's intestinal 'shield effect' will greatly improve the bird's immune system through reinforcement of intestinal mucosal architecture and overall immune competence of the birds. There are sufficient recent findings to indicate that probiotics may interfere with quorum sensing (bacteria signalling system) in avoiding the onset of virulence in some micro-organisms.

Field application of probiotics

The positive effects of probiotics on poultry can be very useful as an alternate replacement for antibiotic growth promoters (AGP) to improve bird performance and enteric disease control in poultry production. Probiotics can be applied in broilers to improve body weight gain, feed conversion, reducing mortality or disease challenge (for example salmonella, E. coli or clostridium).

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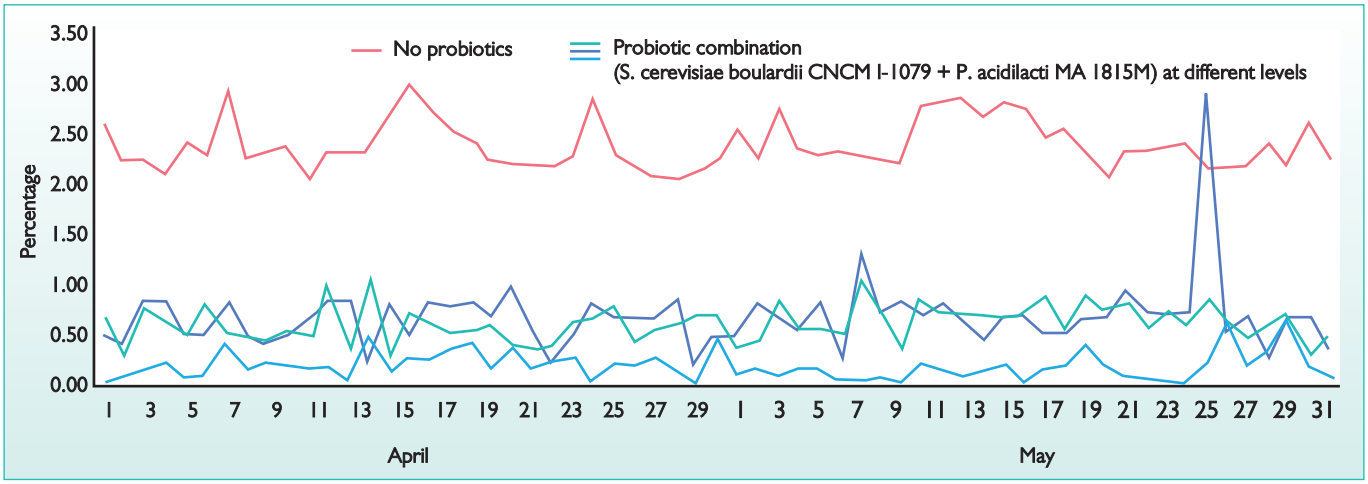

Fig. 1. Effect of probiotics on rejected eggs in commercial layers.

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Table 2 Illustrates the result in performance improvement and economic benefits of probiotic yeast in combination with AGP in coloured broiler birds under field condition. For layers and breeders, probiotics of bacterial or yeast origin (or in combination with other additives) will improve egg production rate, egg quality (egg weight, downgraded eggs, shell quality and yolk colour) and pathogen reduction, especially salmonella organisms.

Fig. 1 demonstrates a significant reduction of rejected egg numbers with in feed application of a combination of a probiotic bacteria with yeast (S. cerevisiae boulardii CNCM I-1079 + P. acidilacti MA1815M) at different dosage levels in a commercial brown layer farm.

Summary

The use of probiotics has been shown to be a useful tool in maintaining a well balanced gut microflora for pathogen reduction and improving performance in poultry.

The main area of concern for probiotic use in poultry is the potential for virulence and antibiotic resistance genes being transmitted by the undefined microbes.

The criteria of selecting an effective probiotic for poultry use should take into account no gene transfer of antibiotic resistance, proper labelling of the product (exact taxonomic species and strain stability), ability of probiotic organisms to survive in the gastrointestinal tract (bile and acid resistance) with good adhesion capability and antibiotic susceptibility. Proper and prudent use of probiotics can be an important tool for intervention in the reduction and control of foodborne pathogens and as an alternative replacement for antibiotic growth promoters in the near future. ■

References are available on request from the author