The use of essential oils and their compounds in poultry nutrition

Essential oil blends should be regarded as one of the tools available to animal nutritionists in formulating diets for poultry. Further research is continuing to develop our understanding of the real potential of these products.

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Essential oils (EO) are volatile oils obtained from plants, normally by steam and/or water distillation. Their active compounds can also be produced in 'nature-identical' form – with identical chemical structure to the naturally occurring raw materials and their extracts. In order to achieve a recognised 'nature-identical' level under food legislation, these products must be at least 99.5% identical to the natural materials.

The wide-ranging effects of EO's are widely acknowledged in humans and – more recently – in animals. Not only can they function individually, but their effects can also be enhanced through synergistic effects both between individual EO's and in combination with other feed additives. For CRINA S.A. essential oil blends, it is the synergism between individual essential oils which continues to produce the most profound benefits to animal production.

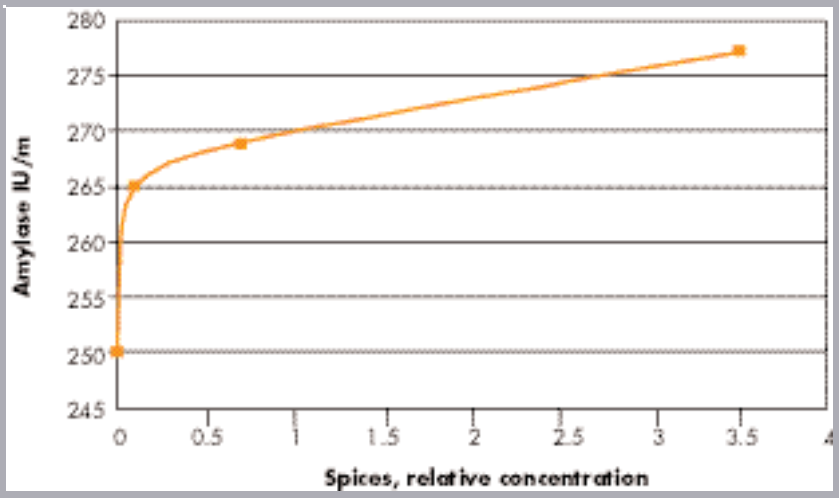
Two specific areas to indicate the potential for these products in animal nutrition are: the stimulation of endogenous enzymes by spice extracts; and the regulation of gut microbial flora – both of which help to maintain the health and performance of animals.

Stimulating endogenous enzymes

By increasing the concentration of amylase and other endogenous enzymes, the characteristics of food substrates in the gut can be altered. For example, one effect is that of reducing digesta viscosity. This was demonstrated in a broiler trial using diets based on wheat and barley. Inclusion of a blend of EO (CRINA Poultry (patented)) not only improved feed efficiency by 5% from 1 to 40 days of age, but also had a significant effect on reducing digesta viscosity *(Table 1)* and the percentage of birds with sticky droppings *(Table 2)*. The significance of the effects of the essential oils vary with diet. In a separate experiment 6 x 150 broilers were fed *ad libitum* diets based on either wheat or maize (50-60%). Viscosity of the gut contents was measured in the ileum on day 24 *(Table 3)*. While viscosity was significantly reduced in the wheat-based diet substrate, there was little effect in the less viscous substrate produced on the maize-based diet.

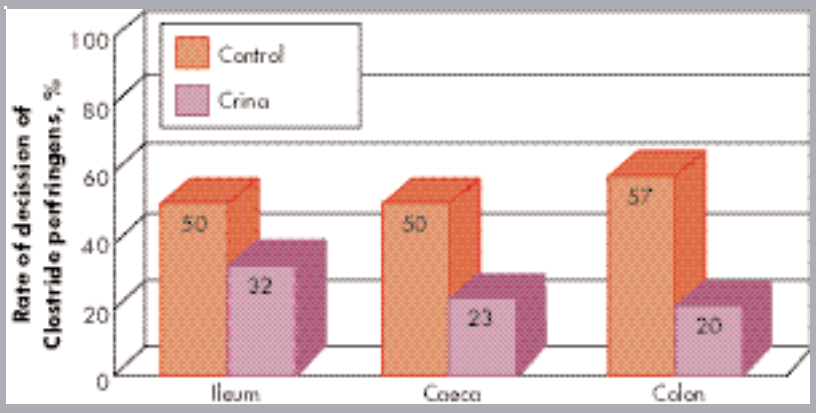
Changes in the intestinal substrate such as these can be expected to lead directly to improved feed absorption and utilisation. However, they will also result in a shift in the microbial colonisation of the intestine.

Figure 1. Essential oils stimulate increased levels of amylase in the duodenum



Number of animals: 35 broilers
Source: CRINA S.A. Switzerland & TNO ILOB, Netherlands, 1999

Figure 2. Effect of EO on the development of Clostidium perfringens type A in the intestine of broilers



Source: Dr. B. Köhler, Germany , 1997

Table 1. Viscosity of the ileal digesta (cP)

Control	*Virginiamycin*	*Enzyme*	*CRINA*
9.0	9.3	3.0	6.0

Table 2. Sticky droppings (%)

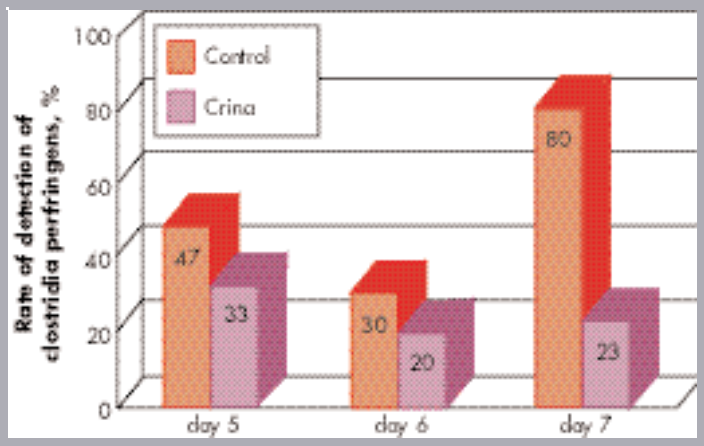
Control	*Virginiamycin*	*Enzyme*	*CRINA*
50.0	55.0	19.0	21.0

Table 3. Viscosity of ileal digesta (cP)

	Negative Control	*Positive control*	*CRINA*
Wheat based diet	1.64 [ac]	1.77 [ac]	1.47 [a]
Maize based diet	1.22 [b]	1.33 [b]	1.36 [b]

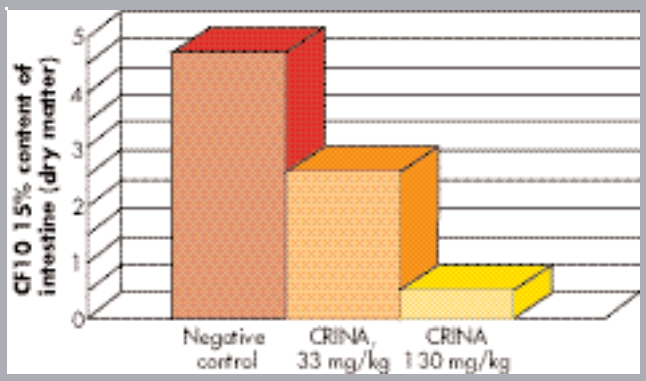
[a, b, c]:p<0.05

Figure 3. Frequency of detection of clostridia perfringens



Source: Dr. B. Köhler, Germany , 1997

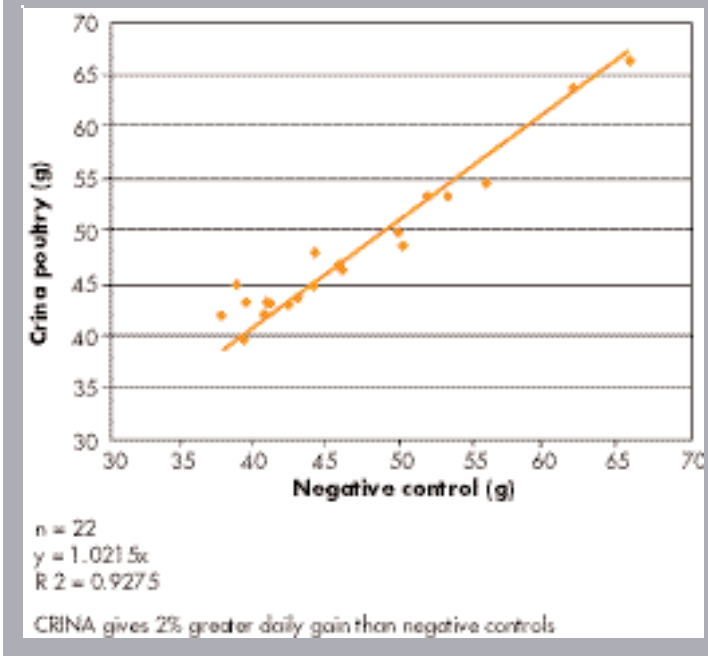
Figure 4. Effects of the essential oils on the average concentration of clostridia perfringens



EFFECTS ON GUT MICROFLORA
Number of animals: 3 x 5 broilers
Sample: Intestinal content at day 13
Supplementation: 50 mg/kg CRINA HC for poultry for experimental group I, 100 mg/kg CRINA HC for poultry for experimental group II
Feed composition: Wheat/soja commercial feed from Holland

Source: In connection with Dutch Cooperative, 1999

Figure 5. Regression analysis – daily weight gain for broilers



Effects on the microbial flora

A series of trials (Köhler, 1997) were undertaken to investigate the effect of a specific blend of essential oils on the intestinal colonisation of *Clostridium perfringens*. Two groups of ca. 30,000 birds on a diet based on wheat, soya and peas were compared. A control group received 20 ppm zinc bacitracin as a growth promoter. For the treatment group the zinc bacitracin was replaced by 50 ppm of the EO blend *(Figures 2 and 3)*.

Supplementation with the EO blend reduced the concentration of *Cl. perfringens* in the ileum, caecum and colon. By day 32, the number of birds infected with *Cl. perfringens* was 70% lower on the EO group. The birds with the EO blend produced greater daily weight gain than the control group.

Such trials demonstrate that the EO blend is exerting some control on the colonisation of the broiler intestine by *Cl. perfringens*. The improvement in daily weight gain is likely to be linked to a consequent increase in levels of natural antagonists to *Cl. perfingens* in the intestine. These effects arise in part due to a direct inhibition of the bacteria, but are also the result of the changed substrate brought about by the increased endogenous enzyme levels.

Effects of the essential oils are dose-dependent. This has been shown in trials where the effects of zero, 50 ppm and 100ppm essential oil blend were compared for their effects on levels of Cl. perfringens *(Figure 4)*.

At the higher dose of EO (100 ppm) the concentration of *C. perfringens* was 20% that of the lower dose (50 ppm) and only 10% of the levels found in the control birds.

Performance improvements

Experience indicates that this specific blend of essential oils is able to produce benefits comparable to traditional growth promoters in maintaining health and performance of birds. Compared with controls without any growth promoters benefits in the range of 2% to 6% can be expected. *Figure 5* shows the results of 22 separate research institute and commercial trials around the world in which daily gain was on average just over 2% higher on CRINA-fed birds than controls. h