

ATP supply could ensure the chicken brain to detect day light, secrete reproductive hormones and regulate smooth muscle contraction with oviposition (Castro, 1995). Therefore, the maintenance requirement of creatine for breeders might be higher than that for broiler chickens. However, breeder diets are commonly vegetable-based low protein diets which is deficient in creatine. Thus, all creatine requirements in breeders rely on the endogenous synthesis. It is well-known that the developing embryo is totally dependent on the nutrients available in the egg. Eggs usually contain low levels of creatine (Ramirez et al., 1970; Murakami et al., 2014) but during incubation, the synthesis of creatine steadily increases as indicated by an increasing activity of the key-enzyme L-Arginine-Glycine-Amidino-transferase.

After 6 days of incubation, increased creatine content can be detected in the embryo (Ramirez et al., 1970). Obviously the chicken embryo is totally dependent on ATP synthesis to support the energy demanding growth and hatching process (Molennar, 2010). Thus, the question arise if the supplementation of a creatine source to breeder diet might have an effect on the performance of the parents, embryos and progenies as it might relieve the metabolism and enhance the cell's energy transport and buffer capacity.

A study was conducted at the University of São Paulo, Brazil using 120 broiler breeders (Cobb 500) between 50 and 60 weeks of age. Birds were allocated in a completely randomized design to 5 dietary treatments supplemented with CreAMINO® at different levels (0.00%, 0.04%, 0.08%, 0.12% and 0.16%), with

six replicates per treatment and four broiler breeders per pen. Adding 800 g and 1200 g CreAMINO® /MT to broiler breeder diets, significantly increased hatchability and fertility (Table 2). Carry over effects of feeding CreAMINO® to the breeders were evaluated for their progeny which were fed regular corn-soy diet that contained no supplemental GAA. A significant improvement in FCR of progeny was observed in the corresponding treatment of the breeders (Table 2).

Commercial broiler breeder trials:

Table 3 summarizes the commercial trial results, indicating that adding 0.1% GAA in commercial broiler breeder diets unanimously increased the hatchability of eggs in broiler breeders up to 5%. Therefore, the maintenance requirement of creatine in broiler breeders may be much higher than expected due to immediate and stable ATP demand for breeding and embryo growth. Supplementation of 0.1% GAA can meet this requirement to improve the fertility and hatchability of eggs in poultry breeders. (Table 3)

Summary

For modern poultry, endogenous supply of creatine is not sufficient to support the optimal production and performance. Supplementation of CreAMINO® can successfully improve broiler performance both in full vegetable diets and diets containing animal protein sources. Inclusion of CreAMINO® at 0.1% to broiler breeder diets improved the reproductive parameters and performance of progenies. Thus, creatine can be classified as conditionally essential nutrient for the poultry as the demand cannot fully be compensated by de-novo synthesis. ■

Table 2. Effect of CreAMINO® on reproductive parameters of broiler breeders and progeny performance

Parameters	CreAMINO®, %				
	0.00	0.04	0.08	0.12	0.16
Breeder trial					
• Fertility %1	80.27 ^b	85.15 ^{ab}	96.51 ^a	96.43 ^a	81.76 ^b
• Hatchability %2	65.66 ^b	65.59 ^b	83.76 ^a	83.95 ^a	65.04 ^b
Progeny trial					
F• CR g/g	1.61 ^b	1.51 ^{ab}	1.44 ^a	1.48 ^a	1.61 ^b

^{ab} Values within a row with different superscripts are significantly different, 1P < 0.05; 2P < 0.07 (ANOVA, Tukey test)

Table 3. Effect of 0.1% CreAMINO® supplementation on hatchability (%) of commercial broiler breeders

Country	Breeder	Age (weeks)	Control diet	CreAMINO® diet	Difference
• Argentina	Cobb 500	40-45	71.6	74.0	2.4
• Argentina	Arbor Acres plus	42-59	78.4	79.4	1.0
• Brazil	Ross 308	65-72	55.0	60.0	5
• Brazil	Cobb 500	44-53	77.5	78.9	1.4
• Mexico	Cobb 500	53-60	86.2	89.6	3.4

Average improvement in hatchability (%) :2.64

Reducing protein and energy rates in feed while maintaining broiler zootechnical performance: Case study of Nor-Spice AB® supplemented feed

By Amine Benarbia (DVM, PhD) and Sébastien Tessier (Area Manager), Nor-Feed

The genetic improvements in broilers achieved in recent decades has allowed for significant increases in zootechnical performance and improved productivity (Hocking 2014). However, the expression of this genetic potential depends on optimal feeding and livestock condition.

Determination of the required amount of energy and protein in feed is probably the most important decision to be made when it comes to feed formulation for broiler producers. Providing a well-balanced feed in order to meet the needs of broilers in terms of protein and energy while reducing feed cost is a real challenge.

Furthermore, broiler producers, in order to meet sustainable agriculture standards have to optimize the use of resources in feed formulations and reduce the use of antibiotics as growth promoters. Energy and protein comprise more than 70% of the total cost of feed. The challenge facing broiler producers is how to optimize



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tial. This trial investigated the effect of Nor-Spice AB® supplementation in a “low-cost” feed reduced in protein and energy – the most expensive inputs. Here, the aim of this study was to answer the question whether it is possible to reduce protein and energy and still achieve optimal zootechnical performance by supplementing feed with Nor-Spice AB®.

Small inclusion rate for a high ROI under Asian conditions:

This study was conducted at the Bangkok Animal Research Center (BARC, Thailand) in order to assess the effects of Nor-Spice AB® supplementation under Asian livestock con-

ditions. A total of 216 newly hatched male broiler chicks (Arbor Acres Plus) were randomly allocated to three feed formulations with six replications using 12 male birds in a pen. A standard corn-SBM feed and a low-cost feed (-5% energy, -7% crude protein) for each growing phase was formulated.

Table 1. experimental groups

Group	feed
• G1	Standard feed
• G2	Low-cost feed
• G3	Competitive feed (Low-Cost Feed + 250 ppm NSAB®)



Sébastien Tessier

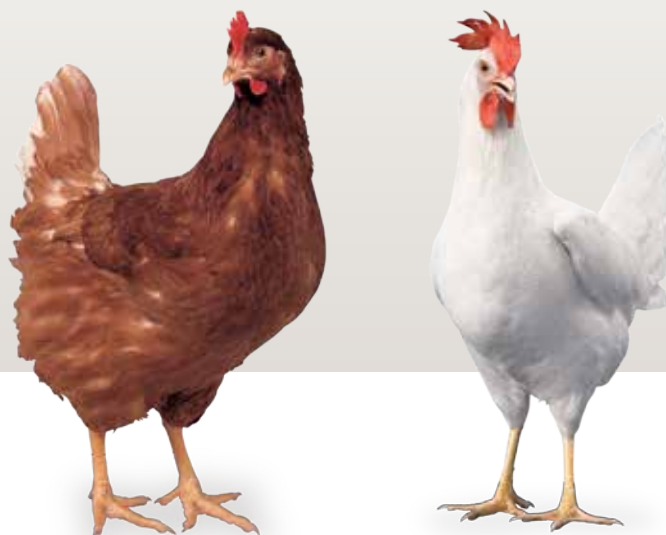
feeding costs and maintain performance in order to be competitive.

Nor-Spice AB® is a citrus concentrate containing a set of well characterized phytochemical compounds: citroflavonoids, pectic oligosaccharides (POS), organic acids, limonene and citrus essential oil. Several trials demonstrated that feed supplemented with Nor-Spice AB® contributes to improved zootechnical parameters over breeder feed recommendations.

Variability of raw materials, their cost and/or scarcity can lead to the formulation of unbalanced feed. As a consequence, broilers fed may have difficulty expressing their full genetic poten-

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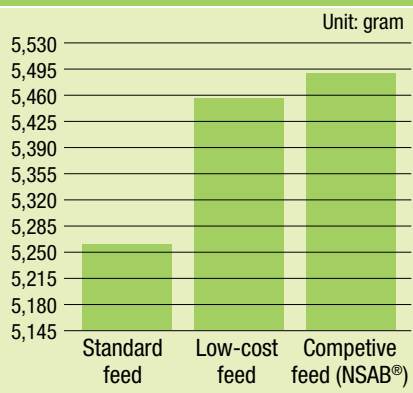
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Better feed intake for higher productivity:

Feed intake was better in animals fed competitive feed (250 ppm Nor-Spice AB®) compared to animals fed Standard feed or “low-cost” feed without supplementation. (Figure1). Feed intake is a complex and multifactorial parameter. Some elements like heat stress tend to decrease feed intake with economic consequences on final body weight and carcass quality whereas feed palatability will tend to increase it.

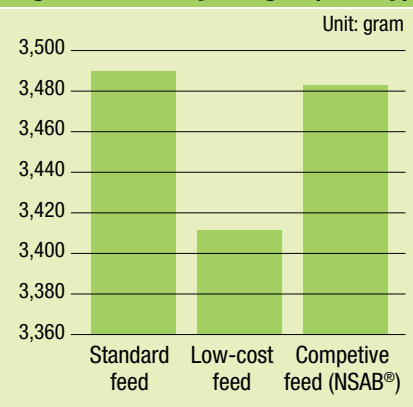
Figure 1. Feed intake (0-42 day)



Animals fed low-cost feed supplemented with Nor-Spice AB® reach the same body weight as animals fed optimal feed:

As expected, animals that received “low cost” feed had a lower final body weight compared to animals fed optimal feed. This loss in body weight was nearly fully compensated by Nor-Spice AB® supplementation. Indeed, animals fed competitive feed (Nor-Spice AB®) not only tended to show a higher final body weight compared to animals fed “low cost” feed but also reached nearly a similar final body weight as animals fed the standard feed (Figure2). This result suggests that feed supplemented with Nor-Spice AB® may contribute to improved final body weight in the reduced protein and energy feed.

Fig 2. Final body weight (42 day)

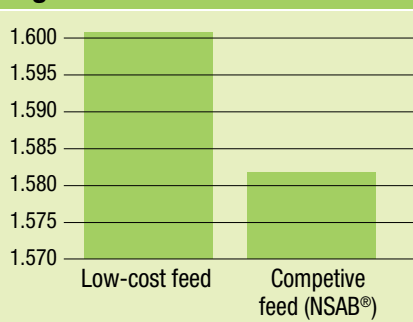


An improved FCR and a trend to higher livability with the competitive feed:

Animals fed the competitive feed demonstrated a better FCR compared to animals fed “low-cost” feed, 1,582 and 1,601 respectively. (Figure 3). Livability in animals fed competitive feed was higher compared to animals fed either low-cost feed or standard feed (Figure 4).

According to these data, competitive feed probably contributed to improved livability in broilers in these experimental conditions.

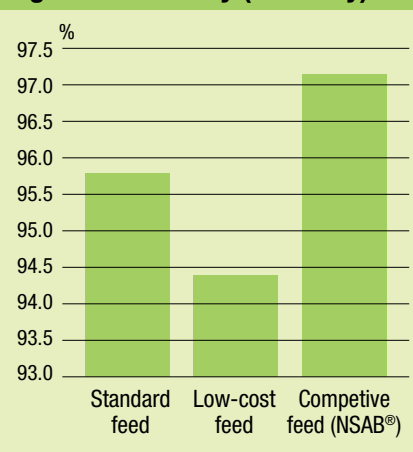
Figure 3. Feed conversion rate



Less cost, better productivity:

Depending on the region, feed cost ranges from 65% to 71% of the total investment in a flock. Any savings that can be achieved without losing zootechnical performance will have a positive impact on productivity. In this trial, “low-cost” feed supplemented with Nor-Spice AB® is 11.63% cheaper than optimal feed. This was mainly due to the reduction in what is most costly in feed: protein and energy. However, this reduction in protein and energy had no impact on broiler performance when feed was supplemented with 250 ppm of Nor-Spice AB®. Moreover animals fed “low-cost” feed supplemented with Nor-Spice

Figure 4. Livability (0-42 day)



AB® tended to show better livability compared to animals fed optimal feed. This is another element that gives the use of Nor-Spice AB® a good return on investment (ROI). In the case of this trial we obtained an ROI of 3:1. Despite a high FCR in animals fed “Low-cost” feed compared to animals fed optimal feed, the cost of production remained cheaper and even more competitive as described in table 2 and 3

Table 2: Nor-Spice AB® ROI

LCFN (250ppm NSAB® Vs LCF	
FCR: -1.2%	
Chicken weight increase/T of feed	+7.5kg
Extra gain /ton of feed	300 baht
Cose of Nor-Spice AB/T of feed	100 baht
R.O.I.	3:1

Chicken price: 20 baht/kg
NSAB price: 400 baht/kg

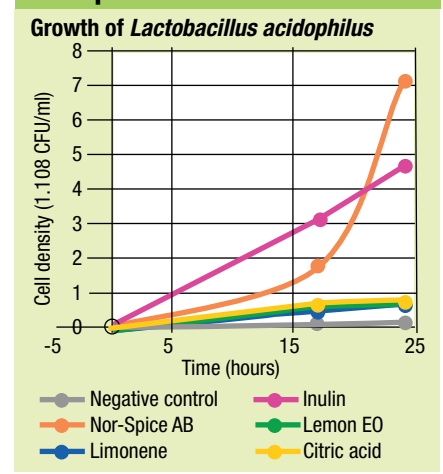
Table 3: Nor-Spice AB® ROI

Nor-Spice AB® Vs Optimal feed	
FCG (baht/kg of meat)	
FCG (Feed Cost/gain) Std feed	23.5 baht
FCG Nor-Spice AB	21.9 baht
Difference	-1.6 baht
Gain per 1,000kg of chicken	1,600 baht
Standard feed price	15.56 baht/kg
NSAB feed price	13.75 baht/kg

Control of intestinal microbiota for a healthier intestine and better nutrient assimilation:

Animals fed with “low-cost” feed tended to display similar results as animals fed optimal feed in terms of final body weight and better results in terms of livability. These data confirm previous studies made on Nor-Spice AB® supplementation

Figure 5: Prebiotic effect of Nor-Spice AB



Trial	Location	Duration (days)	Number of animals	Positive control	Growth improvement	FCR improvement
1	France INRA Le Magneraud (experiment farm)	24	25 Ross chicken/group	-	+4.4%	-4.0%
2	Switzerland (experiment farm)	42	4200 Ross chicken	-	+2.0%	-0.6%
3	Denmark, commercial farm	35	80 broilers in each group	-	+1.9%	-3.6%
4	United Kingdom, commercial farm	43	102000 broilers	-	+4.1%	-6.1%
5	France, INRA Tours Nouzilly (experiment farm)	23	20 Ross chicken/group	-	+2.3%	-3.5%
6	Taiwan, commercial farm	26	16,900 chicken in control group, 6,500 broilers in trial group	-	+4.7%	-2.8%
7	Canada, research center	42	204 broilers	AB used as growth promote	+2.4%	-2.4%
8	India, commercial farm	42	160 broilers in each group	Furazolidon & oxytetracyclin	+4.0%	-1.9%
9	France, commercial farm	35	22,400 broilers in each group	Avilamycin (10ppm then 8ppm)	+4.5%	+0.4%
					3.4%	-2.8%

in feed (Olivier Clech Et Al 2012; Chicoteau Pierre Et Al 2001). One way to explain the observed effect can be that Nor-Spice AB® is rich in POS and citroflavonoid with a strong and proven prebiotic effect. Several trials demonstrated that Nor-Spice AB® enhances the growth

of lactobacillus acidofilus (figure 5). It is established that enhanced probiotic growth in the intestine has a direct positive impact on intestinal health which in turn impacts positively on nutrient assimilation and bird performance. On the other hand, limonene, citroflavonoid,

organic acids and essential oils contained in Nor-Spice AB® have been shown to have an antimicrobial effect against several pathogenic bacteria (Chueca, Pagán, et García-Gonzalo 2014; BERG 2001). Based on that, results of this trial suggest that lowering bacterial pressure at gut level associated with the prebiotic-like effect of Nor-Spice AB® as described above improves gut health which has positive consequences observed on growth and livability of animals fed competitive feed.

There are several studies supporting our finding and hypothesis: gut health and nutrient assimilation can be improved by phytogetic additives with positive consequences on broiler zootechnical performance (Ahmed et al. 2013).

This study among others demonstrated that supplementation with 250 ppm of Nor-Spice AB® to a low-cost feed makes it competitive due to the reduction in price and the maintenance of performance, not only under Asian conditions, but all over the world as summarized in table 4. This opens up new opportunities for using phytogetic additives instead of chemical additives to optimize broiler production in a more competitive and sustainable way. It may also represent an important step that modern poultry producers can take towards a more sustainable livestock industry. ■

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