



TECHNICAL
PAPER

towards a more responsible antibiotics use in asian animal production:

supporting digestive health with
essential oil compounds

Towards a more responsible use of antibiotics in Asia



Provimi's blends of essential oil compounds for swine and poultry are uniquely formulated to optimize gut health and performance under low medication and AGP-free conditions.

In recent years, Asian countries have moved progressively towards reducing the use of antibiotic growth promoters (AGP) and subsequent antimicrobial resistance in livestock production.

This year alone (2018), Vietnam and Indonesia have announced measures to eliminate or limit the use of AGP in feed, joining China, South Korea and Thailand in the move towards reduced AGP in livestock production. China has banned the use of colistin, an antibiotic known as a "last resort" drug when dealing with multi-resistant bacteria, while authorities in Thailand have set a target to reduce colistin consumption by 70% and restrict its usage to therapeutic applications.

Such moves send a powerful message on the importance of developing more sustainable practices and finding alternative ways to keep animals healthy.

Adjusting to the new norm

For both feed and animal producers, the idea of abruptly removing AGP from their operations is a concern. However, growing evidence has shown that the use of sub-therapeutic doses of antibiotics for growth promotion purposes no longer delivers the same level of benefits as it used to decades ago.

Reviews from Van Boeckel et al. (2015) and Laxminarayan et al. (2015) suggest that the use of antibiotics for purposes other than disease treatment is usually associated with a less than 1% improvement in productivity for broilers and grower/finisher pigs, and around 5% in nursery pigs. It must be noted that data for these studies were collected in regions where farm management standards and hygiene practices are at a relatively advanced level.

Gut health strategy

Countries which have successfully transitioned away from excessive antibiotic use have done so by relying on comprehensive approaches including enhanced biosecurity measures, strict animal husbandry practices, and better raw material selection and feed design.

Today, a significant part of the gap between observed commercial performance and animals' true genetic potential can be attributed to gut health challenges. As the largest immune organ in the body, the gut, or gastrointestinal tract, is crucial to helping the animal deal more effectively with potential infections and challenges in the farming environment.

An effective strategy for digestive health should therefore encompass a clear and complete understanding of gut functions. Delivering measurable and consistent benefits to the animal requires a multi-factorial approach, starting with good nutrition at the core.

Using essential oil compounds (EOCs), while gradually reducing the use of dietary growth promoters, could be a suitable animal health strategy in the interim

Essential oil compounds as a solution

From a digestive health perspective, the use of specific feed additives carefully selected for their broad and/or complimentary modes of action can offer a valuable option.

One category, in particular, is phytogetic feed additives. These are plant extracts, essential oils (EO), or blends of essential oil compounds (EOC) that have gained significant traction within the industry. Although the efficacy of EO/EOC is sometimes called into question, it must be noted that the quality and effectiveness of EO/EOC depends largely on the stability of the active ingredients owing to the volatile nature of EO, as well as their concentration levels.

While EO/EOC have been proven to deliver antimicrobial benefits, their multiple modes of action and subsequent benefits are not limited to bacterial control. Effective EO/EOC products leverage on the biological properties of different EO components to create blends that effectively address various challenges in commercial farming, particularly in the area of digestive health.



Although feed additives are known to provide some benefit in at least one aspect of gut function, EO/EOC exhibit the broadest range of benefits that include:

- Antimicrobial activity
- Modulation of immune response
- Antioxidant activity
- Improvement of nutrient utilization
- Stimulation of mucus production

Recent reports have suggested that EO/EOC can also act synergistically with antibiotics to prevent or inhibit the development of bacteria and further support gut health and performance. Langeveld et al. (2014) and Yap et al. (2014) have shown that numerous EO/EOC and antibiotic combinations can exhibit additive or synergistic effects against a broad range of bacteria relevant to livestock operations. The combination of EO/EOC and antibiotics may also help to reduce bacterial resistance mechanisms.

It is interesting that a solution commonly positioned to reduce the need for antimicrobials can actually work in harmony with these products. Regions where therapeutic, sub-therapeutic or prophylactic uses of antibiotics are not prohibited yet could introduce EO/EOC in combination with antibiotics in a gradual move towards an antibiotic-free future. Such an approach could help them maintain profitability and performance without radically changing the way they do business.

Essential oil compounds to the test: **Cinergy™** and **Biacid™** trials on swine and poultry in Vietnam

To help producers in Vietnam reduce their reliance on AGP, Provimi collaborated with a local university to gain a better understanding of how selected blends of EOC (Cinergy™ for swine, Biacid™ for poultry) can be applied together with or as an alternative to antibiotics.

Two trials were conducted using nursery pigs raised in a commercial environment in two different pig farms located in southern Vietnam. Studies were designed using a similar format which included three dietary treatments. The first treatment (AGP), or basal diet, consisted of a commercial formulation based on local raw materials and nutrient specifications. Antibiotics were included at the level permitted by local authorities at the time of the study. The second treatment (AGP+EOC) involved supplementing the basal diet with a stabilized blend of EOC adapted to the targeted species. Finally, in the third treatment (EOC), all antibiotics were removed from the basal diet and replaced with the same blend of EOC used in the second treatment.



Results (Table 1 and 2) showed that the best growth performance was achieved with the combination of antibiotics and essential oil compounds (AGP+EOC), reinforcing the idea of potential additive or synergistic effects in such a feeding strategy. In the first study (Table 1), pigs given the EOC treatment had lower weight gain versus those given the AGP diet. However, other parameters such as feed conversion ratio (FCR), mortality, frequency of diarrhea and the need for veterinary intervention (i.e. injection of antibiotics) showed numerical improvements when EOC were administered as a replacement for AGP.

Vietnam swine trials featuring Provimi feed additive, **Cinergy™**

Table 1: Performance of nursery pigs fed diets containing antibiotics (AGP), essential oil compounds (EOC) or their combination (AGP + EOC)

Notes:

- * Each treatment was composed of 6 replicate pens (15 pigs per pen)
- * Pigs were weaned at 26 days of age, with an average bodyweight of 7.3 kg
- * AGP: Doxycycline (150 ppm) and Josamycin (36 ppm)
- * EOC: Cinergy™ concentrate, Provimi (250 g/ton)

(4-weeks trial: 26 to 54 days of age)	AGP	AGP + EOC	EOC
Growth performance parameters			
Average daily gain (ADG), gram/day	301	313	294
Average daily feed intake (ADFI), gram/day	410	403	388
Feed conversion ratio (FCR)	1.36	1.29	1.34
Health status indicators			
Mortality, %	5.56	0.00	3.33
Frequency of diarrhea, %	6.52	5.91	5.26
Frequency of veterinary intervention, %	2.46	2.06	1.70



In the second study (Table 2), both treatments showed similar results, suggesting that EOC were able to maintain the same level of benefits as the antimicrobial compounds they were substituting. The better EOC performance response observed in the second trial could be linked to a better farm environment (the absence of mortality across all treatment points in that direction). These trials demonstrate that blends of EOC can be part of a nutritional solution to help producers gradually wean off their reliance on medicated additives.

Table 2: Performance of nursery pigs fed diets containing antibiotics (AGP), essential oil compounds (EOC) or their combination (AGP + EOC)

- Notes:
- * Each treatment was composed of 7 replicate pens (6 pigs per pen)
 - * Pigs were weaned at 29 days of age, with an average bodyweight of 7.7 kg
 - * AGP: Enramycin (20 ppm) and Neomycin (30 ppm)
 - * EOC: Cinergy™ concentrate, Provimi (250 g/ton)
 - * n.a.: the farm does not inject any medication (antibiotics) to animals, so no data could be recorded

(4-weeks trial: 29 to 57 days of age)	AGP	AGP + EOC	EOC
Growth performance parameters			
ADG, gram/day	388	420	391
ADFI, gram/day	547	571	544
FCR	1.41	1.36	1.40
Health status indicators			
Mortality, %	0.00	0.00	0.00
Frequency of diarrhea, %	4.17	4.25	3.66
Frequency of veterinary intervention, %	n.a.	n.a.	n.a.

In another trial performed under research farm conditions, using a local breed of chicken (Table 3), it was shown that EOC, added either on top of or as a replacement to AGP, were able to further improve performance compared with antibiotics treatment alone. However, unlike the pig trials, the best performance response was obtained with the EOC treatment. While this might come as a surprise, there are reports suggesting that removing AGP from broiler feed does not necessarily decrease productivity, especially when the animals are reared in a low-challenge environment. One possibility is that antibiotics might disturb the intestinal microbiota, inhibiting the development of both pathogenic as well as beneficial micro-organisms. Another possibility is linked to the increased levels of antimicrobial resistance in livestock operations.

Vietnam poultry trials featuring Provimi feed additive, **Biacid™**

Table 3: Performance of native chickens fed diets containing antibiotics (AGP), essential oil compounds (EOC) or their combination (AGP + EOC)

- Notes:
- * Each treatment was composed of 8 replicate units (12 chickens per unit)
 - * AGP: BMD (40 ppm)
 - * EOC: Biacid™ nucleus, Provimi (100 g/ton)

(8-weeks trial: 1-56 days of age)	AGP	AGP + EOC	EOC
Final bodyweight, grams	1,617	1,638	1,682
FCR	2.35	2.37	2.26
Mortality, %	10.4	7.3	4.2
Flock uniformity, CV% of final weight	14.9	13.2	10.8

Provimi works continuously towards advancing animal health with the use of proven, sustainable feeding strategies.

Cinergy™ and Biacid™: proven efficacy on animal performance

Provimi's feed additives for swine (Cinergy™) and poultry (Biacid™) are uniquely formulated to optimize gut health and performance under low medication and AGP-free conditions.

Cinergy™ is an additive blend of stabilized essential oil compounds for swine that provides targeted benefits on the gastrointestinal tract. In the Vietnam swine trials, the AGP+EOC groups outperformed the other trial groups (AGP only and EOC only) on several indicators such as growth performance (ADG 313 grams/day – Table 1; 420 grams/day – Table 2), FCR (1.29 – Table 1, 1.36 – Table 2), and mortality (0%).

Biacid™, an additive blend of stabilized essential oils and organic acids for poultry, works synergistically on pathogenic bacteria in the gut. Essential oil compounds are able to cross through bacteria cell walls, allowing organic acids to enter the cell and induce an osmotic stress on the pathogen, thereby reducing levels of unfavorable bacteria in the gut.

In the Vietnam example, the positive effects of Biacid™ were demonstrated in the growth performance of the EOC-only trial group. Final bodyweight was greatest for this group (1,682 g at 56 days – see Table 3). The EOC group also demonstrated the most efficient FCR (2.26, compared with 2.37 for AGP+EOC and 2.35 for AGP – Table 3), lowest mortality (4.2%, compared with 7.3% for AGP+EOC and 10.4% for AGP – Table 3), and most uniform bodyweight within a flock.

With tighter regulations on in-feed antibiotics, livestock producers are looking for sustainable solutions to meet the challenges of improving animal performance and profitability while reducing antibiotic dependence. EOC has been shown to support animal performance through a positive impact on digestive health, in turn improving feed efficiency, food safety and animal welfare by reducing the risks of bacterial contamination among livestock.

Through R&D in various production environments and markets, Provimi works continuously towards advancing animal health with the use of proven, sustainable feeding strategies.

