DUAL BENEFIT OF EMULSIFIERS: **PERFORMANCE ENHANCER & COST SAVER**

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"To meet the demand for animal protein, optimal feed utilization is key to improve productivity. Maximising output with minimal input will contribute to a more economic industry. One of the most expensive ingredients, fat source, is not being used efficiently because of factors impacting digestion and absorption in the digestive tract. Implementation of a nutritional emulsifier can be a game changer here."

Nutritional emulsifiers are feed additives that are used more and more in diet formulation, with the aim of enhancing fat emulsification in the small intestine. Together with natural emulsifiers (e.g. bile salts), nutritional emulsifiers emulsify the fat globules coming from dietary fat in smaller droplets. Lipase, the digestive enzyme catalysing the hydrolysis of lipids, is therefore able to digest the fat in a more efficient way. Nutritional emulsifiers are also able to emulsify free fatty acids, in order to enhance their absorption in the epithelial cell layer. As nutritional emulsifiers are tightly related to energy efficiency, these feed additives are able to liberate more energy from the diet for animals' performance. Therefore, nutritional emulsifiers can also be called animal productivity enhancers.

Excential Energy Plus is a nutritional emulsifier developed by Orffa Additives B.V. and is based on glyceryl polyethylene glycol ricinolate (GPGR). This GPGR, coming from castor bean oil, is specifically synthesised in a controlled production process to increase its emulsification properties in the watery conditions of the small intestine. The efficiency of Excential Energy Plus has been proven in more than 100 *in vivo* trials among different monogastric and ruminant animal species. However, the action of a nutritional emulsifier depends on several factors including, but not limited to; animal species, dosage, emulsifier active ingredient(s), period of supplementation and feed formulation.

Orffa conducted a global meta-analysis on the effect of Excential Energy Plus as a broiler productivity enhancer and feed cost saver, taking into account these different factors. Three different meta-analysis were implemented; the first to compare the effects of Excential Energy Plus to a control diet without a nutritional emulsifier, and a second meta-analysis to compare the product to a diet with a different commercially available emulsifier. The third one studied the inclusion of the nutritional emulsifier in an energy-reduced diet as a feed cost saver.

META-ANALYSIS AS PRODUCTIVITY ENHANCER: EXCENTIAL ENERGY PLUS VS CONTROL

A systematic review of scientific and commercial trials with Excential Energy Plus has been carried

TABLE 1

Number of selected studies	10
Years of study completion	Between 2014 and 2023
Location of the study	Belgium, China, Colombia, India, Mexico, South Africa, United Kingdom
Total number of broilers	6652
Broiler breed	Ross 308, Cobb 430, Arbor Acres
Broiler sex	Male, 50:50 male and female
Average days of life	37.1
Main formulated cereals	Corn-based (n=8), wheat-based (n=2)
Main formulated fat sources	Animal fat, full fat soybean, palm oil, recycled oils from restaurants, rice bran oil, soybean oil, sunflower oil
Average dietary nutrients	3042.4 kcal/kg (2713 – 3164) metabolizable energy 7.01% (4.95 – 8.30) crude fat 21.59% (21.30 - 21.80) crude protein

out, selecting specific studies that meet the following criteria:

- Performed in broilers;
- Includes detailed information on the feed formulation and nutrient analysis;
- Assess the effect of Excential Energy Plus as productivity enhancer (top-dressing);
- Includes a control with a basal diet without emulsifier and iso-caloric with the treatment diet;
- Contains data on the growth performance, feed intake and feed efficiency of the birds;
- Performed before the end of 2023.

As a result, the studies in Table 1 with trial details were taken into consideration.

The following performance parameters for both treatments (control diet and Excential Energy Plus diet) were compiled for all studies, when available:

- Body weight gain (BWG; g/bird)
- Average daily gain (ADG; g/bird/day)
- Average daily feed intake (ADFI; g/bird/day)
- Feed Conversion Ratio (FCR), recalculated to a body weight of 2500g with the following formula:

$$FCR\ 2500 = FCR - \left(\frac{Body\ weight\ (g) - 2500}{100} \times 0.04\right)$$

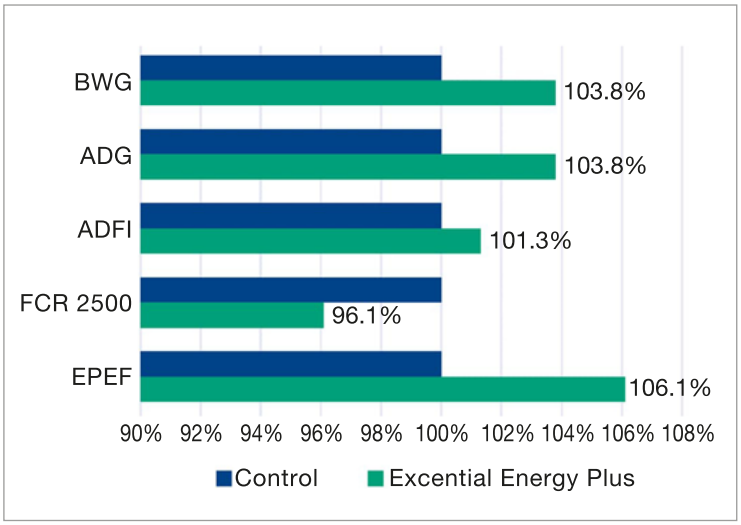
- European Production Efficiency Factor (EPEF), calculated with the following formula:

$$EPEF = \frac{Liveability\ (\%) \times Body\ weight\ (kg)}{Days\ in\ life \times FCR} \times 100$$

Finally, the percentage of change when comparing the data in the Excential Energy Plus group with the control group was calculated with the following formula:

$$Percentage\ of\ change = \frac{Treatment\ group\ data - Control\ group\ data}{Control\ group\ data} \times 100$$

Those results were compiled for each study according to their diet groups and statistical analysis was performed with ANOVA one-way test (significance level $P<0.05$). After studying the effect of each trial, these percentages of change were averaged and plotted per treatment and for each performance parameter. To conclude, applying 350 ppm of Excential Energy Plus on-top of a basal broiler diet is expected to numerically improve growth performance by 3.8%, feed efficiency by 3.9% and production efficiency by 6.1%.



META-ANALYSIS AS PRODUCTIVITY ENHANCER: EXCENTIAL ENERGY PLUS VS OTHER EMULSIFIERS

Nutritional emulsifiers can be based on several types of active ingredients, with all different areas of specialty. Measuring the hydrophilic-lipophilic balance (HLB) value of emulsifiers is an interesting way to classify the products and to find out whether they are lipophilic (for a mix of water in oil) or hydrophilic (for a mix of oil in water). Lipophilic emulsifiers with a low HLB value, such as phospholipids, are commonly known as technical emulsifiers that improve the feed production process.

On the other hand, hydrophilic emulsifiers with a high HLB value, such as the specific GPGR used in Excential Energy Plus, are nutritional emulsifiers improving the emulsification in the watery environment of the gastro-intestinal tract. This clearly explains the need to differentiate the types of emulsifiers *in vivo*.

A second meta-analysis has been conducted to differentiate emulsifiers with variating HLB values. For that purpose, a second systematic review of scientific and commercial trials with Excential Energy Plus has been carried out, selecting specific studies answering the following criteria:

- Performed in broilers;
- Includes detailed information on the feed formulation and nutrient analysis;
- Assess the effect of Excential Energy Plus as productivity enhancer (top-dressing);
- Includes a control with a basal diet, supplemented with another commercial available emulsifier, and iso-caloric with the treatment diet;
- Contains data on the growth performance, feed intake and feed efficiency of the birds;
- Performed before the end of 2023. (Table 2)

The same performance parameters as in the previous meta-analysis, for both treatments, were compiled. Statistical analysis was performed as in the first meta-analysis. Afterwards, the percentage of change when comparing the data in the Excential Energy Plus group with the other emulsifier group was calculated similarly to the first analysis. After studying the effect of each trial, the percentages of change were averaged and plotted per treatment and for each performance parameter. To conclude, applying 350 ppm of Excential Energy Plus is expected to numerically improve growth performance by 1.7%, feed efficiency by 2.8% and production efficiency by 2.5%,

TABLE 2

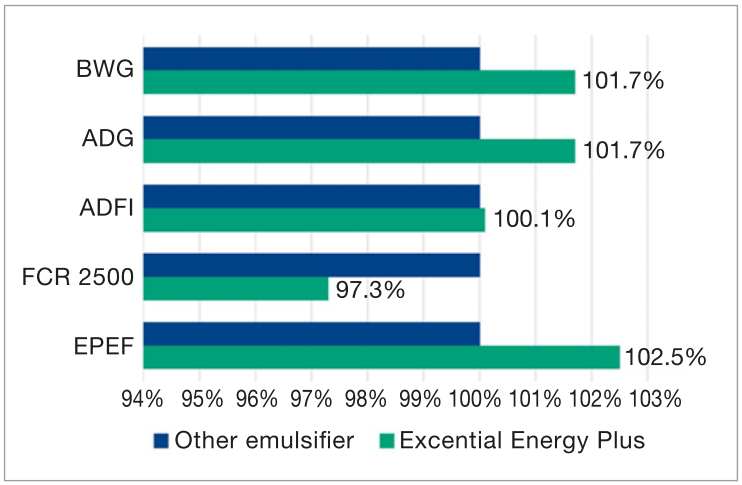
Number of selected studies	7
Years of study completion	Between 2014 and 2021
Location of the study	Belgium, Colombia, India, Netherlands, Poland, United Kingdom
Total number of broilers	8455
Broiler breed	Ross 308, Cobb 430
Broiler sex	Male, female, 50:50 male and female
Average days of life	34.1
Main formulated cereals	Wheat-based (n=6), corn-based (n=1)
Main formulated fat sources	Full fat soybean, palm kernel fatty acid, palm oil, poultry fat, soybean oil
Average dietary nutrients	2978.4 kcal/kg (2713 – 3164) metabolizable energy 6.89% (5.95 – 8.30) crude fat 21.00% (19.92 - 21.60) crude protein
Dosage of Excential Energy Plus	350 ppm (n=7)
Active ingredients of the other commercial available emulsifiers	Lysophospholipids (n=5), GPGR with a different HLB value compared to Excential Energy Plus (n=1), mixture of lysophospholipids, monoglycerides and synthetic emulsifier (n=1)
Dosage of the commercial available emulsifiers	500 ppm (n=6), 1000 ppm (n=1)

compared to the use of other types of commercially available emulsifiers at higher dosages.

META-ANALYSIS AS COSTS SAVER: EXCENTIAL ENERGY PLUS VS CONTROL

Thanks to the improvement of energy efficiency, nutritional emulsifiers enable nutritionists to formulate diets with energy-reduced levels. This feed reformulation is highly related to the initial feed, taking into account the fat sources and the total crude fat (from oils, animal fats and cereals). Therefore, a third meta-analysis has been conducted to review the impact of Excential Energy Plus on broiler performance and feed costs when applied with an energy reformulation strategy. For that purpose, a last systematic review of scientific and commercial trials has been carried out, selecting specific studies answering the following criteria:

- Performed in broilers;
- Includes detailed information on the feed formulation and nutrient analysis;
- Assess the effect of Excential Energy Plus as feed costs saver (reformulation);



- Includes a positive control with a basal diet and a negative control with reduced energy levels;
- Contains data on the growth performance, feed intake and feed efficiency of the birds;
- Performed before the end of 2023. (Table 3)

The same performance parameters as in the previous meta-analysis, for both treatments, were compiled. Those results were compiled for each study according

		TABLE 3
Number of selected studies	17	
Years of study completion	Between 2012 and 2023	
Location of the study	Belgium, Brazil, China, Colombia, Mexico, Peru, Poland, South Korea	
Total number of broilers	24157	
Broiler breed	Ross 308, Cobb 500, Arbor Acres	
Broiler sex	Male, 50:50 male and female	
Average days of life	39.3	
Main formulated cereals	Corn-based (n=12), wheat-based (n=4), corn and wheat-based (n=1)	
Main formulated fat sources	Corn oil, full fat soybean, lard, palm oil, poultry fat, soybean oil	
Average dietary nutrients – Positive control	3045.4 kcal/kg (2915 – 3125) metabolizable energy 7.35% (4.93 – 9.21) crude fat 20.49% (19.60 - 21.63) crude protein	
Average dietary nutrients – Negative control	Reduction by 79.4 kcal/kg (40.0 – 170.0) the metabolizable energy 5.54% (2.50 – 8.55) crude fat No change in terms of crude protein	
Average feed costs – Negative control	Reduction by 5.26 USD/ton (4.00 – 7.95) the feed costs, including the cost of the emulsifier	

to their diet groups and statistical analysis was performed similarly to the previous meta-analysis.

To conclude this meta-analysis, no performance parameters were significantly negatively impacted by the reduction of energy when supplementing Excential Energy Plus. On top of that, diet costs were reduced, in average, by 5.26 USD/ton of feed including the cost of feeding the nutritional emulsifier. When taking into account the average feed intake and costs of the diets, a return on investment of 3.44 can be concluded.

SUPPORT OF THE BROILER'S INDUSTRY PRODUCTIVITY WHILE OPTIMIZING FEED COSTS

Nutritional emulsifiers are feed additives that allow for better digestion and absorption of the different nutrients in animal feed. By their key action in the fat and energy metabolism, they optimise the energy utilization of feed that can be used for growth performance. Excential Energy Plus has a well-proven record based on both scientific and commercial trials, to significantly improve growth, feed efficiency and production efficiency, resulting in higher profits. Moreover, a large variety of emulsifiers exist, from technical to nutritional ones, but they can easily be classified by describing their active ingredients and HLB values. Excential Energy Plus, a nutritional emulsifier with a high HLB value, has been demonstrated to increase the performance to a higher extent than other types of commercially available emulsifiers.

Applying 350 ppm of Excential Energy Plus, on-top of a basal broiler diet without emulsifiers is expected to **improve growth performance by 3.8%, feed efficiency by 3.9% and production efficiency by 6.1%**. When applying the product and comparing results with another commercially available emulsifier, **growth performance is expected to improve by 1.7%, feed efficiency by 2.8% and production efficiency by 2.5%**.

Moreover, when applying Excential Energy Plus in energy-reduced diets, it enables to **maintain optimal broiler performance while reducing feed costs by 5.26 USD/ton, and resulting in a return on investment of 3.44**.

About Aurélie Montagnon

Aurélie Montagnon is Central Technical Manager at Orffa Additives BV. Aurélie Montagnon graduated from ISARA, France in 2020, with an engineering master's degree in Agriculture, environment and resources management, with specialty in breeding, nutrition, environment and health.