ADM

CitriStim®

When health & production matter.

body defense • gut health • performance

body defense
gut health
performance

When health & production matter.

body defense

CitriStim® consists of a unique strain of yeast, *Pichia guilliermondii*, used in the production of ADM citric acid. As a whole-cell product, CitriStim is consistently rich in immune factors, including nucleic acids, mannans, and beta-glucan. Basic research and extensive field application show that this unique organism exerts a powerful influence on immunity, gut health, and animal performance.

Immunity: Research shows CitriStim alters immune signaling in the intestine, helping activate key innate immune defenses such as macrophage recruitment (see Figure Two). Importantly, this immune signaling does not raise a generalized inflammatory response in the gut, helping preserve critical nutrients for animal performance.

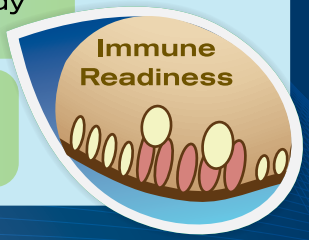
Gut health: *In vitro* research shows that some pathogens may adhere to whole *Pichia guilliermondii* cells thereby lowering the adherence of pathogenic bacteria to intestinal cells (see CitriStim in Action graphic). *In vivo* research shows that CitriStim may cause a more rapid clearing of pathogenic organisms and have a positive effect on growth performance during experimental infections.

Performance: Controlled research shows that CitriStim supplemented animals respond with better performance in most production systems.

BODY DEFENSE

Triggers key natural body defense mechanisms

Immune signaling assists in preserving critical vital nutrients

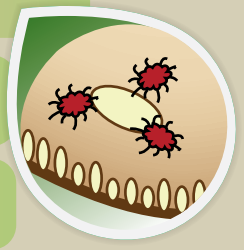


GUT HEALTH

Pathogens adhere to *Pichia*, instead of intestinal cells

Allows for a more rapid clearing of pathogens

Allows for a positive effect on growth



PERFORMANCE

Research shows better performance in numerous species and production systems

Research documents . . .

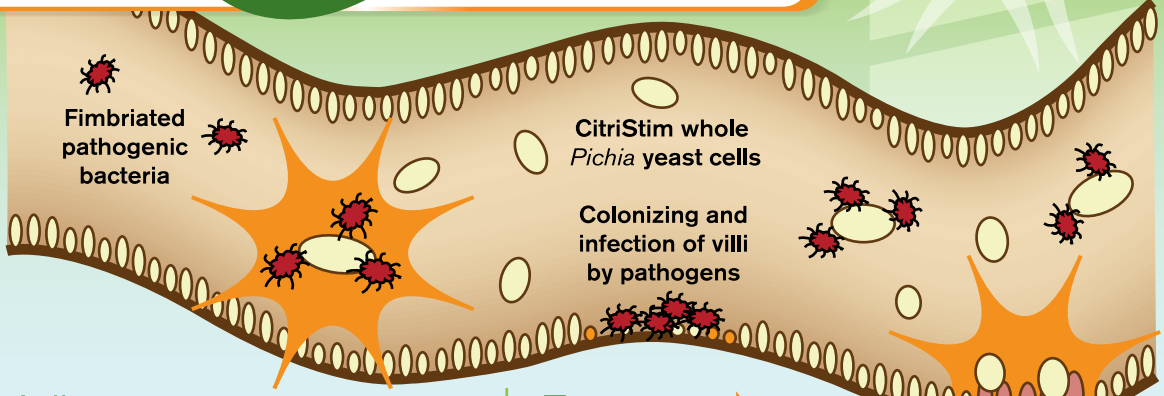
Better gain and feed efficiency

Lower morbidity

Healthier animal

body defense • gut health • pe

CitriStim IN ACTION



Adherence of intestinal fimbriated pathogens

Pathogenic bacteria adhere to yeast cells protecting the intestinal *villi*

Triggering of body defense

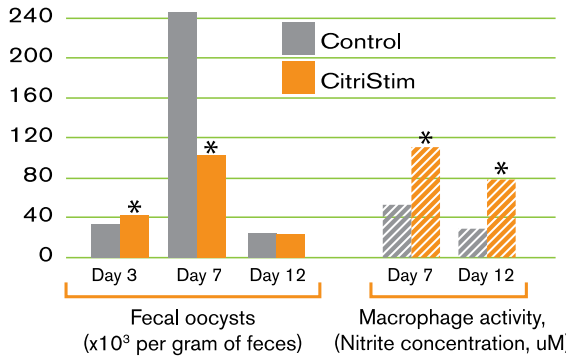
Mucosal immune cells process yeast cell β-glucan and yeast mannans which elevates overall immune activity

CitriStim stimulates immune macrophages.

erformance

Fig. Two

Impact of CitriStim on macrophage activity and fecal oocyst counts after a coccidial challenge in broilers



*CitriStim differs from control P < .05
(Poultry Sci. 92:358-363, 2013)

Research Results

Poultry: Broilers, chickens, ducks, and turkeys supplemented with CitriStim responded with 2% better ADG and 5% better feed efficiency.

CitriStim has been shown to enhance immunity and performance of broilers during a coccidial challenge (see Figure Two on inside panel) to minimize the impact of opportunistic gut pathogens during coccidial challenges (*Poultry Sci.*, 92:358-363, 2013).

Pigs: From weaning to 60 lb live weight, CitriStim supplemented nursery pigs had higher ADG (3%) and better feed efficiency (2.5%).

CitriStim has been shown to modulate sow immunity and increase immune transfer to piglets, resulting in better farrowing performance (see Figure One below).

Dairy calves: CitriStim supplementation resulted in better ADG (up to 10%) both pre-weaning and immediately post-weaning.

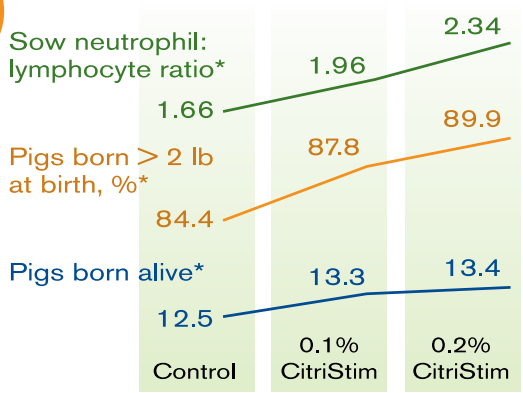
Stressed beef cattle: Receiving cattle supplemented with CitriStim had better ADG (10%) and feed efficiency (7%).

Trials with heat stress and fescue toxicosis show CitriStim to be an essential component of a stress management program.

Aquaculture: Research trials with shrimp and many fish species show that CitriStim may lower morbidity and enhance performance in high stress production systems.

Fig. One

Impact on immunity and farrowing performance of sows fed CitriStim during gestation



*Significant linear effect P < .01
(J. Anim. Sci. 90:445-447, 2012)

ADM field observations

also indicate the following may occur . . .

- Lower morbidity for all species
- Less scouring with disease challenges
- More resistance to stress-related immune challenges

specialty ingredients

CitriStim®

Feeding Recommendations

Poultry:	1-4 lb/ton (0.05-0.2%) of complete feed
Swine:	1-4 lb/ton (0.05-0.2%) of complete feed
Beef and Dairy Cattle:	
Preweaned calves:	2-4 grams/head/day
Growing calves:	1-2 grams/100 lb body weight/day (2 to 4 lb/ton of complete feed)
Adult cattle:	1-2 grams/100 lb body weight/day (2 to 4 lb/ton of complete feed)
Aquaculture:	2 to 4 lb/ton (0.05-0.2%) of complete feed
Companion animals:	2 to 4 lb/ton (0.05-0.2%) of complete feed

Applying **new technology** to **feed ingredients** for **better health** and **production responses**. It's what you would **expect** from ADM.

S9869G-0114

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ADM®