Bear River Zeolite (BRZ™) is a natural volcanic origin rock called "clinoptilolite" that is one of over 40 zeolite minerals. BRZ™ is used for water filtration, cation removal, and as a anti-caking agent in livestock feed at 2% in the daily ration to absorb moisture, maintain flow and inhibit mold development. The equine daily rate is 2oz per 1000lb bodyweight.

This document was prepared to provide a compilation of data from world-wide zeolite (clinoptilolite) studies to be used as an informational resource. Benefits from studies cannot be claimed by Bear River Zeolite, Co. due to U. S. and Canadian government restrictions.

Natural Clinoptilolite

FEED EFFICIENCY RESEARCH Ivanov, R.V. 1997

Research on 30 Sakha Horses was conducted in Yakutsk (Sakha Republic, Russia) during the autumn and winter. Average winter temperatures in the region fall below -35°C/-31°F, creating an increased need for energy from feed. The daily diet of experimental groups consisted of hay, oats and clinoptilolite at a rate of 70g/2.469 oz per head.

Results:

- **The experimental group weighed 5kg/11lb more than the control group at the end of the experiment with a 15% higher daily increase.**
- **Blood sugars were 45% higher in experimental horses, which may suggest higher propionate production during digestion, since this effect was observed in studies on other species.**
- **Clinoptilolite inclusion in feed showed improved nutrient digestion with a 6.8% increase in the amount of exchanged energy from consumed feed.**

OVERALL HEALTH BENEFITS

Research into various health benefits with clinoptilolite has been ongoing for years. Positive results have been shown in animal studies at varying degrees. Some effects are more significant than others, but most likely it is the collective effect that supports homeostasis.

Immunities Fratric, 2005, Zarcula, 2010, Stojic, 2003

Newborn dairy calves and piglets were shown to have higher levels of immunities with clinoptilolite supplementation and the immunities were maintained for a longer duration.

Toxin and pathogen binder Katsoulos, 2016, Ortatatli, 2005

Dairy cattle and poultry studies have shown reductions in mycotoxins (primarily Aflatoxin B1, A & M1), Salmonella and E. coli with supplemental clinoptilolite.

Antioxidant Wu, 2015

Free radicals were inactivated and eliminated when bound in the clinoptilolite lattice to protect poultry from oxidative stress.

Micronutrients and energy from feed Karatzia, 2016, Katsoulos, 2005, Katsoulos, 2005, Strakova, 2008, Alexopoulos, 2007

Clinoptilolite has an affinity for ammonium and will capture nitrogen during digestion through cation-exchange, then gradually release it during digestion to sustain energy. The process is selective and doesn't capture essential micronutrients and trace elements, as shown through serum concentration in dairy cattle, dairy goats, swine, and poultry studies. In fact, clinoptilolite contains potassium and calcium, which can release to free up space during cation-exchange. (*see page 2 for more information on cation-exchange*)

Ammonia control Meisinger, 2001, Cai, 2007, Rhodes, 2003, Omar, 2015, Ndegwa, 2008, Bujnak, 2015, Sardis, 2002, Eng, 2003,

Clinoptilolite's ability to adsorb ammonium when fed and when applied to stable bedding reduces ammonia formation to support respiratory health. The dessicant properties also inhibit the development of mold and fungi.

Bone density Herzig, 2008, Kavan, 2013

Clinoptilolite fed in poultry studies increased lodgement of Ca, P, Mg and crude protein in the femur and tibiotarsus.

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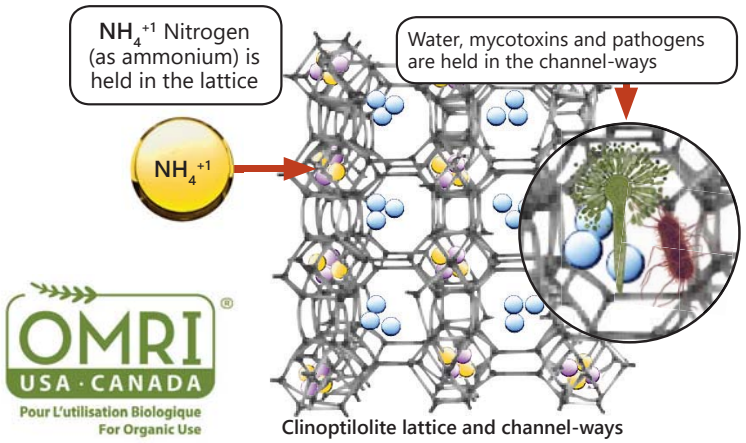
CATION EXCHANGE*

BRZ™ has a high aluminum (Al^{3+}) clinoptilolite framework, giving it a negative charge that captures and holds multiple cations through cation-exchange.

- Ca, K, and Na are released from its lattice in exchange for ammonium (nitrogen) and heavy metals depending on their molecular size, competing cations, and concentrations.
- Ammonium and other harmful cations are exchanged into the lattice where they are not water soluble. The process is selective and doesn't capture essential micronutrients and trace elements.
- High adsorption capacity for polar mycotoxins, such as aflatoxins, and ability to capture pathogens in the channelways for removal in manure.
- Potassium in clinoptilolite exchanges with the calcium in the animal to help solubilize phosphorus. The net effect is that the phosphorus is better utilized and bone growth is enhanced.
- The manure from BRZ™ fed horses contains more nitrogen, potassium and calcium to provide nutrients for plants and buffer soil.

Clinoptilolite also absorbs water during digestion, which can slow passage rate and allow for more time for nutrient absorption in the hind gut.



Clinoptilolite lattice and channel-ways

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*Data on file at Bear River Zeolite Co.