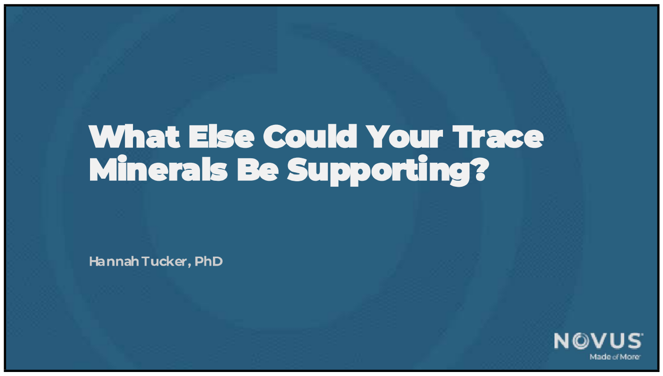
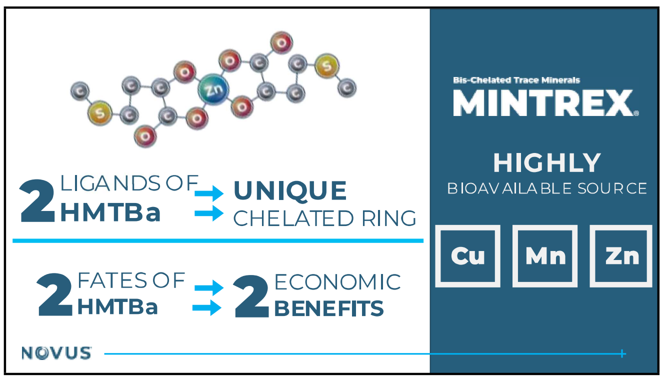
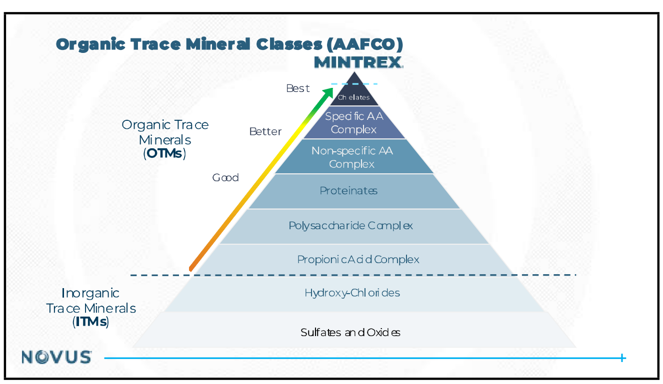

What Else Could Your Trace Minerals Be Supporting?
Hannah Tucker, PhD
NOVUS
Made of More


Zn
S
O
C
2 LIGANDS OF HMTBa
UNIQUE CHELATED RING
2 FATES OF HMTBa
2 ECONOMIC BENEFITS
Bis-Chelated Trace Minerals
MINTREX
HIGHLY
BIOAVAILABLE SOURCE
Cu
Mn
Zn
NOVUS


Organic Trace Mineral Classes (AAFCO)
MINTREX
Best
Better
Good
Organic Trace Minerals (OTMs)
Inorganic Trace Minerals (ITMs)
Chelates
Specific AA Complex
Non-specific AA Complex
Proteinates
Polysaccharide Complex
Propionic Acid Complex
Hydroxy-Chlorides
Sulfates and Oxides
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Organic Trace Mineral (OTM)

Definitions

Organic: Chemical compounds that have carbon-hydrogen bonds

Minerals that are bound to a "LIGAND"

Ligand: Carbon-hydrogen containing molecule, such as an amino acid, peptide

Properties

- The mineral is bound using covalent bonds
- They have higher bioavailability and stability than other inorganic trace mineral sources

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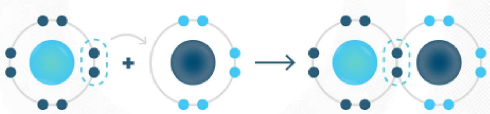
Covalent Bonds in Mineral Chemistry

A coordinate covalent or dative bond is a covalent bond that forms when both electrons come from the same atom



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MINTREX® - The Bis-Chelate

MINTREX® Bis-Chelated Trace Mineral

- Ligand: HMTBa
  - Alpha hydroxy methionine analogue
- Two chelate rings of 5 atoms each formed when *4 oxygens connect to the metal*
- *Defined structure by X-ray crystallography*

In feed applications, the most stable chelation rings are those formed by hydroxy acids*

**Diego, 2018, Development of new metal chelates for animal nutrition and of analytical methods for their quantitative determination and quality control, Parma University (Italy)*

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NUTRITION AND NOVUS PRODUCTS PLAY A ROLE

MINTREX® MEANS

[1]Bach et al., 2015, [2]Nemec et al., 2012, [3]Zhao et al., 2015, [4]Tucker & Vázquez-Añón, 2018, [5]Caldeira et al., 2014

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What About the Ligand?

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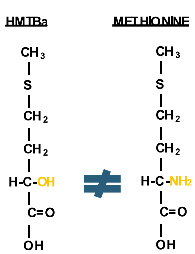
HMTBa is an Organic Acid



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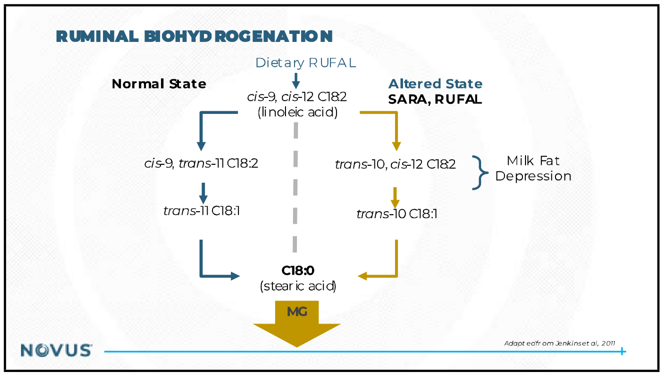
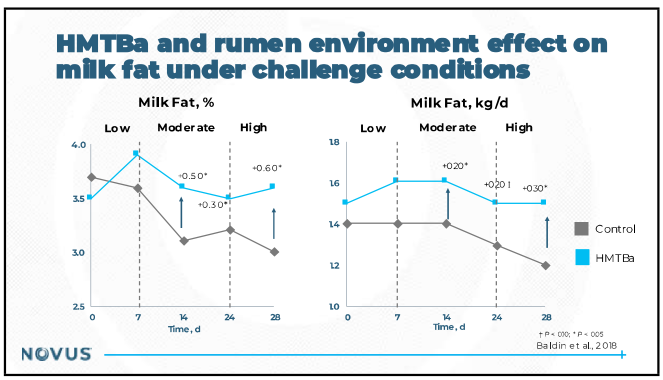

RUMINAL BIOHYDROGENATION
Dietary RUFAL
Normal State
cis-9, cis-12 C18:2
(linoleic acid)
Altered State
SARA, RUFAL
cis-9, trans-11 C18:2
trans-10, cis-12 C18:2
Milk Fat Depression
trans-11 C18:1
trans-10 C18:1
C18:0
(stearic acid)
MG
NOVUS
Adapted from Jenkins et al., 2011


HMTBa and rumen environment effect on milk fat under challenge conditions
Milk Fat, %
Low
Moderate
High
+0.50*
+0.30*
+0.60*
Time, d
Milk Fat, kg/d
+0.20*
+0.20 †
+0.30*
Control
HMTBa
† P < 0.10; * P < 0.05
Baldin et al., 2018
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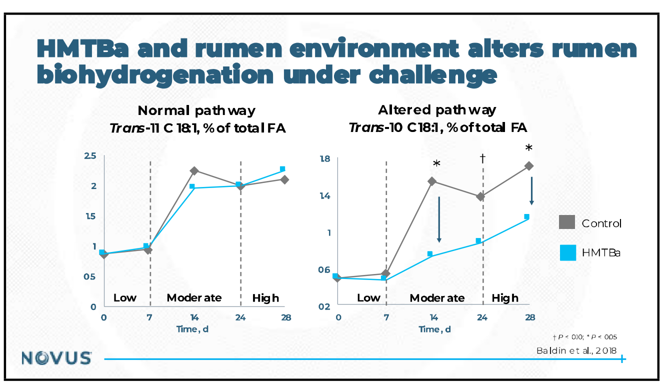
HMTBa and rumen environment alters rumen biohydrogenation under challenge
Normal pathway
Trans-11 C 18:1, % of total FA
Altered pathway
Trans-10 C18:1, % of total FA
Low
Moderate
High
Time, d
Control
HMTBa
† P < 0.10; * P < 0.05
Baldin et al., 2018
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HMTBa ROLE IN THE RUMEN FOR MILK FAT

- HMTBa prevents shift to altered biohydrogenation pathway as demonstrated by:
  - Blunted milk fat losses
  - Reduced production of trans-10 C 18:1
  - Increased biohydrogenation capacity
  - Greater bacterial mass and diversity
- Overall, HMTBa alters the rumen environment to protect cow performance from insults that will result in milk fat depression through ruminal bacteria population modulation.
- **Because this is a rumen response, the adaptation time (or time to see a response) can take 2-3 weeks.**

Baldin et al., 2018, 2019, Pitta et al., 2020

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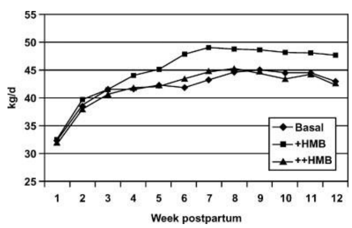
HMTBa increased Milk postpartum – 3 kg/d for cows fed 0.10% of diet DM prepartum



Piepenbrink et al., 2004

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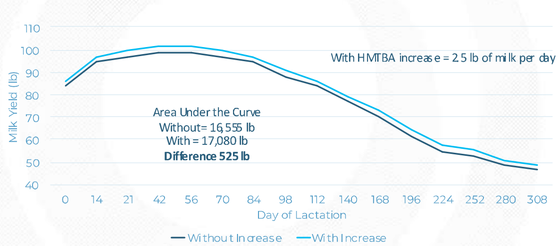
How does feeding HMTBa prepartum impact postpartum milk production?



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Impact of HMTBa in the field

- Highest milk fat responses in diets with:
  - Low NDF
  - High starch
  - High RUFAL
  - Low effective fiber
  - High byproduct inclusion
- And in situations of stress:
  - Heat
  - Crowding
  - Sorting
  - Transition
- Economic return depends on starting point

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Does the HMTBa work in MINTREX®?

Fully Active Molecule

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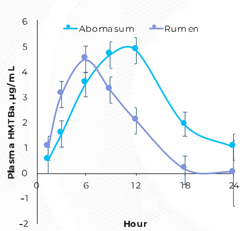
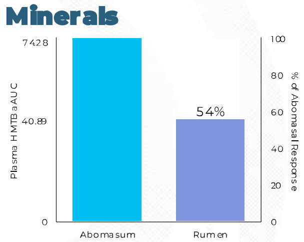
Bypass Methionine Value of MINTREX® Bis-Chelated Trace Minerals





Zanton et al, 2012

Average value from 5 experiments is 54%

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MINTREX® Bis-Chelated Trace Minerals provide HMTBa

MINTREX® Product	Metal, %	HMTBa, %	Rumen Bypass, %	Intestinal Absorption, %	Metabolizable Methionine, %
MINTREX® Zn	16 (160 mg/g)	80	54	100	43
MINTREX® Cu	15 (150 mg/g)	78	54	100	42
MINTREX® Mn	13 (130 mg/g)	76	54	100	41

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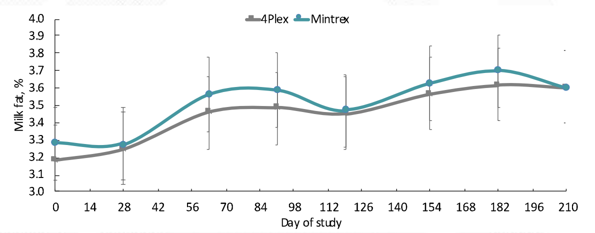
Can a low level of HMTBa provide economic return?

Treatment P = 0.88 Treatment x Time P = 0.001; 12.4 g/h/d fat



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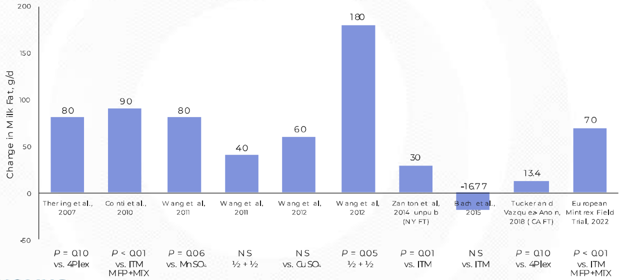
Tucker and Vazquez-Anon, 2018

MINTREX® Bis-Chelated Trace Minerals Increases Milk Fat Yield



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MINTREX® Bis-Chelated Trace Minerals Recommendations

Lactating Dairy Cows

Total Diet	Zn, ppm	Mn, ppm	Cu, ppm*
2021 NASEM 45 kg milk/day	60	30	10
MINTREX® product form, g/day	4	2	0.5

* Copper supplementation varies depending on base diet copper, presence/absence of antagonists and copper status of cows.

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MINTREX® Bis-Chelated Trace Minerals Recommendations

Dry Cows

Total Diet	Zn, ppm	Mn, ppm	Cu, ppm*
2021 NASEM	28	40	17
MINTREX® product form, g/day	2	1	0.5

* Copper supplementation varies depending on base diet copper, presence/absence of antagonists and copper status of cows.

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Bis-Chelated Trace Minerals

MINTREX®

a **NOVUS** *product*

HIGHLY BIOAVAILABLE SOURCE

Zn Mn Cu

2 LIGANDS OF HMTBA

2:1 UNIQUE CHELATED RING

MAXIMUM DELIVERY TO ABSORPTION SITES

GREATER TISSUE ENRICHMENT

Take Home Points

- Fully active molecule
  - HMTBa value
    - 2 in 1 Methionine and Component Effect
  - Organic trace mineral
- Future conversation: where to best utilize molecule? Best rate of return?
  - Transition cows
  - High cows

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