



Feeding the Soil and Growing Animal Protein Value

Ethan Carter

January 30, 2025

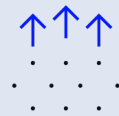
Giving every end a new beginning

We help move the world toward a more circular economy. We restore purpose to millions of tons of material from the animal agriculture and food industries – helping to nourish people, feed animals and crops, and fuel the world with renewable energy.



Collect

We collect materials from the animal agriculture and food industries, helping these industries be more sustainable by providing an alternative to landfilling and incineration.



Process

We separate the materials into fats and proteins, and also extract water – treating and returning more water back to the environment than we use.



Create

We create the highest value for our fats and proteins, which go on to nourish people, feed animals and crops, and fuel the world with renewable energy.

Contributing to a more sustainable world

15%

of the world's animal by-products processed.

12B⁺

gallons of water returned to the environment

3B⁺

pounds of low CI feedstock for biofuel produced

52K

homes provided with green electricity

2M

CO₂ equivalent of ~2 million cars removed from the road

Why does a Rendering Company Have a Fertilizer Business?

- **Profit Center**
 - Like all businesses, making money is critical to sustainability
- **Internal Hedge to Protein Price Fluctuations**
 - Tend to widen margins in bearish protein markets
 - Conversely, margins can be compressed in bullish markets
- **Contingency Planning**
 - Fertilizer can provide a home for rejected feed loads or unplanned production



Markets Served

- Organic Agriculture
- Golf Course
- Lawn Care
- Sports Turf
- Retail/Big Box (Private Label)



What Key Darling Inputs are used?

Feather Meal

Meat and Bone Meal

Bone Meal

Blood Meal

Other Inputs are sometimes blended for specific use cases

How do These Inputs Provide Fertility Value?

Feather Meal:

High protein translates into high organic Nitrogen (12-14%)

Meat & Bone Meal:

More balanced Nitrogen, Phosphate & Calcium source (5-10% N; 6-15% Avail P2O5 & Ca)

Note: Difference in P vs. Available P2O5 ($P \times 2.29 = \text{Avail. P2O5}$)

Bone Meal:

High Phosphate & Ca (15-30% P2O5 & Ca)

Blood Meal:

Similar to Feather Meal, high organic N. Price inconsistency and light bulk density limit use of this material.

What Determines an Organic Fertilizer's Value?

How much organic nutrition is in the formulation?

- Chemical analysis informs what we have

How available are the nutrients for feeding the soil, and then the plants?

- Properly processed protein makes it available to the soil/plant

Nature Safe adds value by applying science and expertise in animal nutrition to soil and plant fertility

Feed the soil microbe like you would an animal!



Meat & Bone Meal in Fertilizer

Fertilizer does not require species identification.

Customers don't seem to care about derivation.

Labeling in the U.S. has one BSE related restriction:

“Do not feed to animals or apply on pasture land for grazing animals.”



How can fertilizer add to the value of rendered products?

The Challenge

There are hurdles to fertilizer driving value of rendered products

- Organic Demand
 - Organic fruit and vegetable demand is flat to moderate compounded growth
 - Recent food inflation trends have softened demand
- MBM Value Impact
 - Targeting organic fertilizer alone not likely to have a significant impact on volumes/demand
- Value Backstop
 - Composted poultry manure creates a value backstop for MBM
 - Meat & Bone Meal has approximately a 2.5-3x nutrient density advantage

Even with these advantages, this value is less than the current feed value of Meat & Bone Meal

The Opportunity

Leverage the circular bio-economy for increasing value of Meat & Bone Meal

- Renewable Diesel's impact on fat markets could be an example
 - Driven by:
 - Economic development
 - Reducing imported energy
 - Sustainability- reducing emissions and extending finite resources
- Largest exporter of conventional fertilizer?
 - Russia
- Largest consumer of conventional fertilizer?
 - China

Potential Parallels with Renewable Diesel

Renewable Diesel

- Economic development
 - Support for feedstock production
- Reducing dependency on imported energy
 - Domestic production of fuels is incentivized
- Sustainability
 - Reducing emissions
 - Extending life of a finite resource

Renewable Fertilizer

- Economic Development
 - Supporting and incentivizing circular economy
 - Supporting domestic production
- Reduce dependency on imported fertilizer
 - Securing supply
 - Avoiding impacts of global market shocks
- Sustainability
 - Reducing emissions
 - Extending life of a finite resource
 - Enabling circular economy

Addressing Conventional Nutrient Challenge

Phosphate is mined, and has a finite supply

- Rock phosphate supply is estimated in the tens to hundreds of years of availability
- Without phosphate, the ability to feed a growing population is at risk
- Geopolitics can complicate, some of the largest exporters of rock phosphate include:
 - Peru
 - India
 - Pakistan
 - Syria
 - Egypt
 - Jordan
 - Morocco
 - Togo

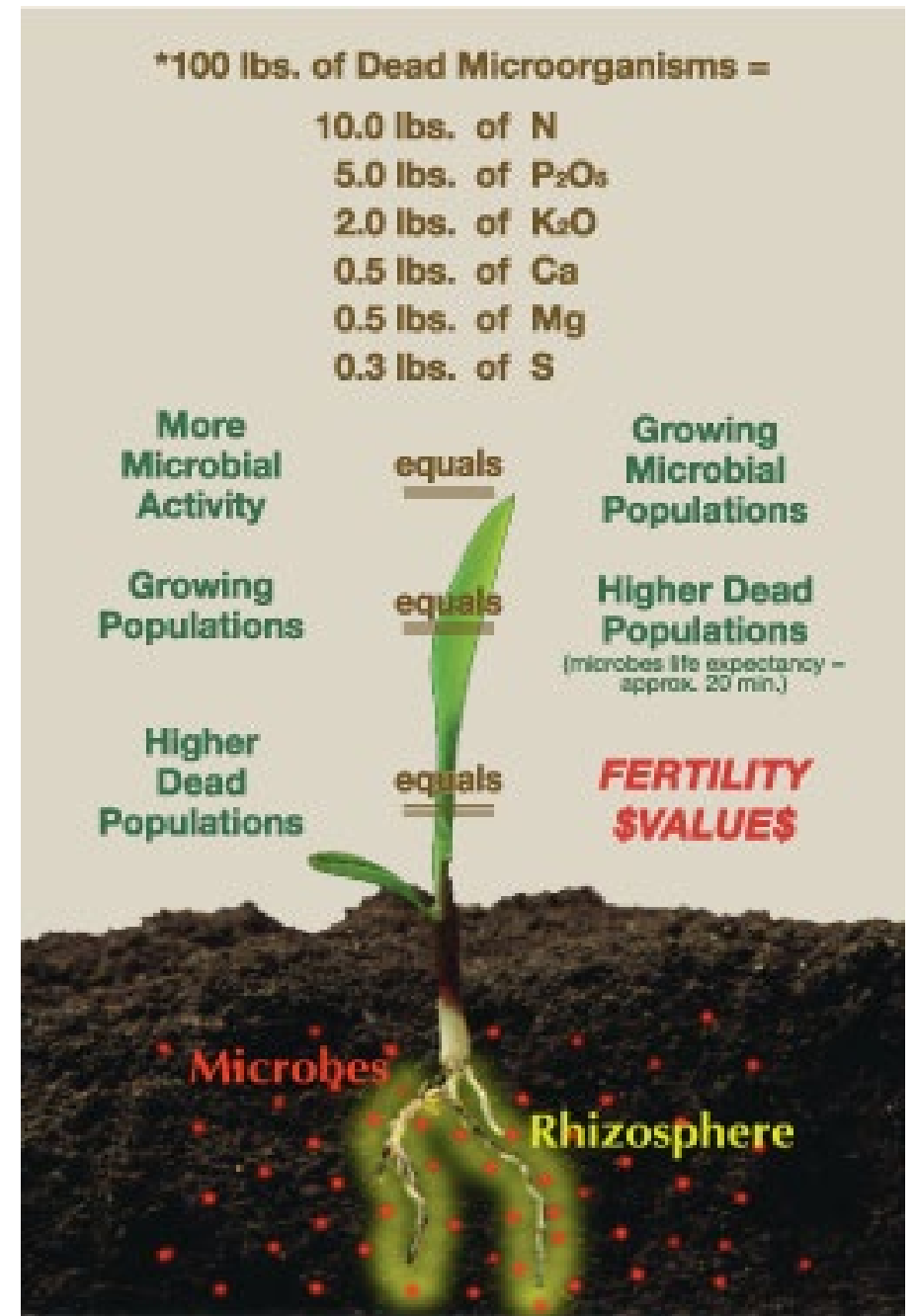
Reminder: Meat & Bone Meal is an excellent source of phosphate: ~2.3x P



Fertilizer Factory Effect

Growing healthy soil microbes increases efficiency

- MBM adds food value to increase microbe activity
- Healthier soil can reduce fertilizer input need
- Potential to lower carbon impact against conventional fertilizer application



* from E.C. Roberts, The Biology of Soil

Catalyzing the Opportunity

What is needed to support?

- Research
- Subsidies/Incentives
- Mandates

Look to the Playbook for Renewable Diesel

- Industry Group Support
- Legislative Engagement
- Messaging the benefits of circular economy
- A compelling call to ACTION

Potential Catalysts:

- Geopolitical challenges with fertilizer trade flows
- Increasing fertilizer demand driven by growing population and food production
- Feeding and protecting one of the world's most precious resources: SOIL
- Sustainability: Animal proteins can feed the soil and improve nutrient availability, while extending conventional fertilizer resources



Thank You

Rick Geise

Director of Compliance and Business Development Nature Safe,
a Darling Ingredients brand

859-572-2558

Rick.Geise@darlingii.com

Ethan Carter

Director of Sustainability
Darling Ingredients

972-657-7921

Ethan.Carter@darlingii.com