

# Midwest Soil Improvement Symposium:

... — 2012 — ...

Research and Practical Insights into Using Gypsum

## ***FGD Gypsum: How It's Made and How to Apply It***

***Ron Chamberlain***

*Agronomist and Director of Gypsum Programs*

***GYPSOIL/BENEFICIAL REUSE MANAGEMENT***



# **FGD GYPSUM: HOW IT'S MADE AND HOW TO APPLY IT**

**MIDWEST SOIL  
IMPROVEMENT SYMPOSIUM  
AUGUST 21, 2012**

Ron Chamberlain

GYPSOIL™ Division of Beneficial Reuse Management

# Topics

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- ☐ Background
- ☐ What is gypsum?
- ☐ Application/Rates/Storage
- ☐ Questions



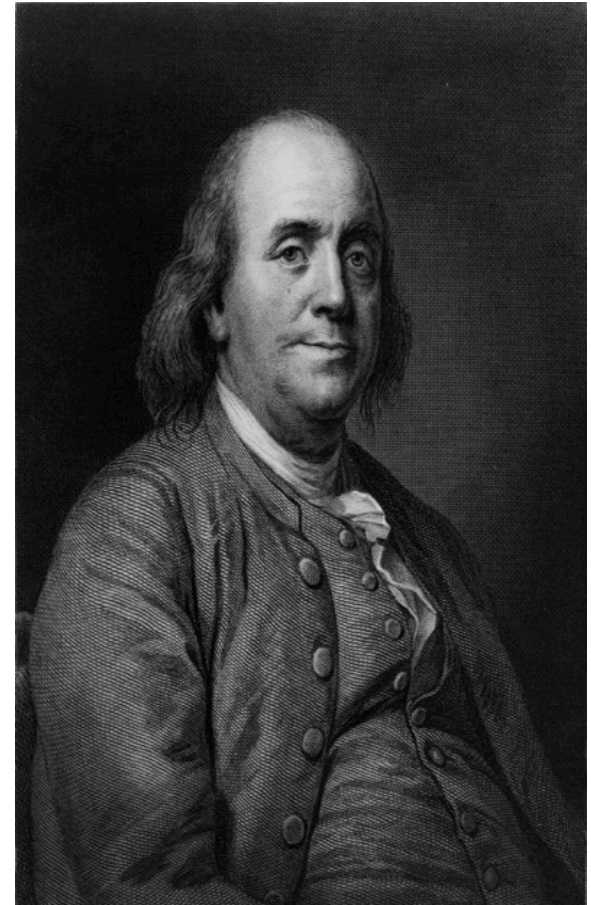
## BACKGROUND

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# Early Use

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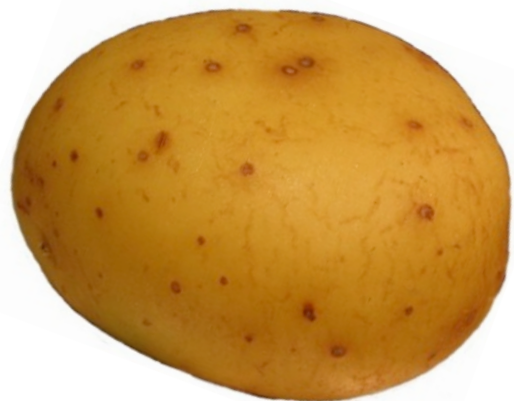
- Ben Franklin saw beneficial effects of gypsum more than 200 years ago
- “This hill has been land plastered!”
- Franklin’s clover grew thicker and greener



# Used on specialty crops

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- Expensive to mine and transport so gypsum use was limited to certain specialty crops



# Clean Air Technology

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- Clean Air Act  
Amendments of 1990
- Wet scrubbers at coal-fired utilities produce synthetic “FGD gypsum”





## WHAT IS GYPSUM?

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# What is gypsum?

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## □ Composition

- $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- Calcium Sulfate Dihydrate

## □ Analysis

- Calcium 20%
- Sulfate Sulfur 16%

## □ 1 Ton

- Calcium 400#
- Sulfate Sulfur 320#



# Gypsum sources

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- Mined gypsum
  - ▣ Limited availability
  - ▣ Costly
  - ▣ Highly variable



# Gypsum sources

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- Synthetic options
  - Recycled wallboard
  - Manufacturing co-product (citric acid, lactic acid)
  - FGD gypsum ←



# FGD Gypsum

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- Supplies to expand dramatically with more scrubbing
- Regulated on a state-by-state basis
- **GYPSOIL** is the primary liaison to help growers access FGD gypsum





# FGD Gypsum

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- Process
  - Starts with high quality, high-calcium limestone
  - Process is preceded by the removal of particulate and NO<sub>x</sub>



# Flue Gas Scrubbing Process

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Ash, metals & NO<sub>x</sub> are removed from the flue gas

Limestone + flue gas  calcium sulfite (CaSO<sub>3</sub>)

Calcium sulfite + oxygen  gypsum (CaSO<sub>4</sub>)

# Metals Concentrations

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We Energy Elm Road			
Metals Concentrations vs Regulatory Standards			
	Metal Concentration		
	Regulatory Limits	Source Levels	We Energy
	40 CFR part 503 Table 3 Sec 503.13	We Energy (Elm Road)	Vs Regulatory Limits
Pollutant	mg/kg	mg/kg	
Arsenic	41	nd	
Cadmium	39	nd	
Copper	1500	1.7	0.1%
Lead	300	n.d.	
Mercury	17	0.29	1.7%
Molybdenum	75	n.d.	
Nickel	420	1.9	0.5%
Selenium	100	1.36	1.4%
Zinc	2800	7	0.3%

# Gypsum Characteristics

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Physical properties may vary depending on source

- FGD gypsum
  - Fine tan powder, damp to the touch
  - 8-10% moisture
- Gypsum from manufacturing
  - White to grey powder
- Mined gypsum
  - More variable





# Gypsum Characteristics

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- Gypsum does not affect the soil pH
  - It is not a liming agent!
- Fine particle gypsum is highly water soluble that allows for easy movement into the soil profile
  - Makes it ideal for no-till and conventional-till farming



# FGD Gypsum: Safe and Effective

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- ❑ USDA-EPA risk analysis
- ❑ GYPSOIL does rigorous testing for purity, moisture and Ca and S content
- ❑ GYPSOIL also makes significant investments in USDA and university research trials



# GYPSOIL sources

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- GYPSOIL has a growing network of supply partners including coal-fired utilities and food grade manufacturing plants



We Energies

# GYPSOIL sources

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- Midwest, Southeast and Mid-south





## APPLICATION/STORAGE

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# Applying GYPSOIL

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- Unlike any other bulk-applied material
- Requires learning process
  - Once you figure it out, it's not difficult





# Equipment

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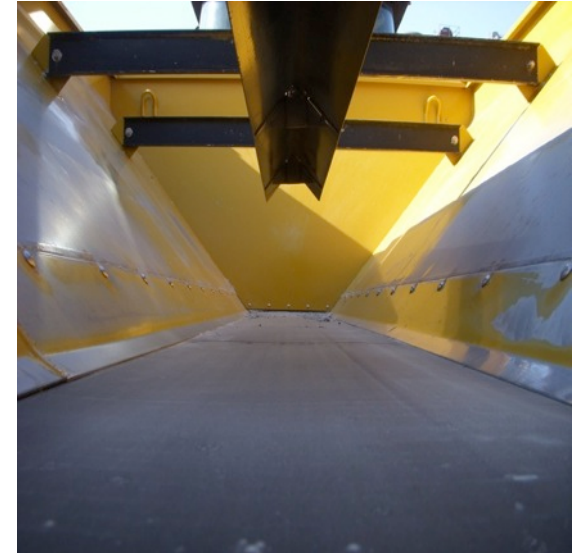
- Ideal:
  - Stainless steel box
  - Steep sides
  - Belt/chain at least 20" wide
  - Twin spinners



# Spreader Box

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- ❑ Requires steep, slick sides
- ❑ Clean and coat rusted areas
- ❑ If not stainless, use plastic liner
- ❑ Treat with SLIP-Plate graphite film coating





# Equipment

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New Leader 30-Series



BBI lime/fertilizer spreader



# Equipment

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Litter & lime spreaders

Chandler



BBI



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# Timing

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- Apply GYPSUM any time that it is appropriate to be in the field without damaging the soil or the crop



# Ideal Application Periods

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- ☐ After harvest
- ☐ Before planting
- ☐ After any alfalfa cutting once crop is off the field



# Incorporation? Gypsum is Flexible

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- Gypsum is water soluble; there is no need to incorporate
- But there's no harm in applying prior to tillage either



# Rates

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- Depends on objectives, circumstances
  - ▣ **Amending soil: 1/2 to 2 ton/acre** (every 1 to 2 years)
  - ▣ **As a nutrient source**, there are established use rates for peanuts, potatoes, and other crops\*

\*In states where gypsum is registered as a nutrient source

# Soil Amendment Guide

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## SOIL ANALYSIS REPORT by MIDWEST LABORATORIES

ORGANIC MATTER		PHOSPHORUS						NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)				pH		CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED)								
		P <sub>1</sub>		P <sub>2</sub>		BICARBONATE P OLSEN		K		Mg		Ca			Na		SOIL	BUFFER	% K	% Mg	% Ca	% H	
		WALKLEY BLACK	WEAK BRAY 1:7	STRONG BRAY 1:7														pH 1:1	INDEX				
PERCENT	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE								
1.8		8		14				61		214		1116				6.4	6.9	8.2	1.9	21.7	68.0	8.4	
2.1		8		11				66		239		1439				6.3	6.8	10.5	1.6	19.0	68.5	10.9	

CEC

Rate

<10

0.5 T/A

10-15

1.0 T/A

>15

2.0 T/A

Goal: Base saturation of Ca = 70% to 85%



# Storing Gypsum



- ❑ Ideal: Under cover
- ❑ If stored in open field or farm lot
  - ❑ > 200 ft. from nearest stream or drainage
  - ❑ Scrape ground bare (remove stalks, grass & debris)
  - ❑ Pile so water drains away from bottom of pile
  - ❑ Pile to a peak (If rain, surface will seal and water will run off)
- ❑ As with all farming materials, keep away from livestock, pets, children

# Various application questions

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- ❑ Q: What will happen if you put too much gypsum on your soil?
- ❑ Q: Would you use a general rate of gypsum on both no-till and min-till soils?
- ❑ Q: What is one time, maximum application rate of gypsum on a loamy sand to improve root structure and tie up aluminum?
- ❑ Q: Do recommend applying every year, or every other year?



QUESTIONS?

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