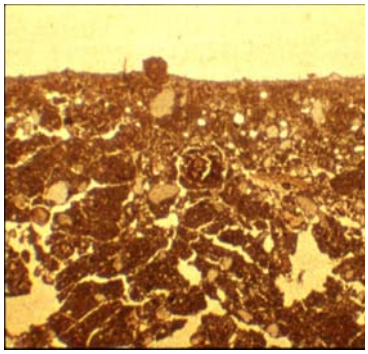
United States Department of Agriculture

Agricultural Research Service

National Soil Erosion Research Laboratory

275 S., Russell St., West Lafayette, IN 47907-2077

FACT SHEET: GYPSUM



Micrograph of soil surface sealed after a two inch rainfall event. The seal limits water infiltration and air exchange between the soil and the atmosphere.

Gypsum factoids

- Gypsum is a natural substance
- Primary component of drywall
- Byproduct of pollution reduction in coal fueled power plants
- Dissolves in rainwater
- Normal application rates of 1-2 ton/acre to soil surface
- Primary cost is shipping

Random corn plants with the same fertility, planting date and genetics from the same field without gypsum on the left and with gypsum on the right.

Gypsum is a naturally occurring mineral that most people know as the main component in sheet rock or gypsum board. It is normally mined for this purpose but increasingly large quantities are produced from the scrubbing of flue gases from coal fired combustors to achieve clean air standards (Synthetic gypsum). Gypsum is calcium sulfate dihydrate ($CaSO_4$ x $2H_20$) with a widely varying range of impurities depending on the geologic formation and it also varies widely in particle size due to the grinding procedure.

Gypsum ready for field application

Synthetic gypsum is normally much purer and has nearly constant silt sized particles due to the nature of the production process. Synthetic gypsum is lower in heavy metals than soil that it is applied to and contains 19% Calcium (Ca) and 15% Sulfur (S) which are both essential plant nutrients that most farmers have not traditionally been concerned with. Most of our soils are naturally high in Ca except when ammended with Dolomitic lime or subjected to acid weathering from addition of acidifying fertilizers. Because of this, the amount of Ca decreases from the natural levels and is replaced by acid, Magnesium (Mg) or Aluminum (Al). Ca for many plants is required in large amounts because of its involvement in such basic cellular processes as cell wall health and strength and must be added to many crops when the ability of the soil to supply Ca is less than the plant requirement. Unlike agricultural lime which needs acid to react with soil, gypsum will react with rainwater and dissolve at a rate of 475 lbs per acre after 1 inch of rainfall. The Ca ions move into the soil where they displace Al ions (if present) which are a major source of soil acidity. Gypsum, per se, is not a liming material since in most states liming materials are defined based on acid neutralizing capacity, however, it may increase pH when the soil acidity is due to exchangeable Al. Since gypsum is a neutral salt the equilibrium pH is 6.7 which is within the optimum range of pH for soil to provide nutrients to plants. **Another significant difference between agricultural liming materials and gypsum is that gypsum can dissolve and move the Ca to lower soil layers where it can alleviate toxic Al effects at depth in the soil profile.** Thus allowing greater depth of rooting which can make significant differences in yields especially when production is limited by available water.

Field after Gypsum applied at 1 ton/ac

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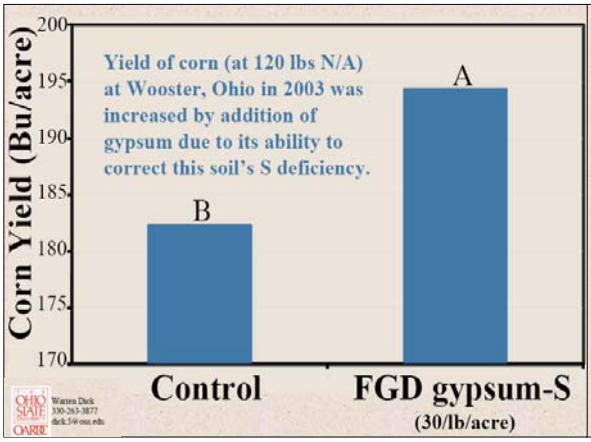
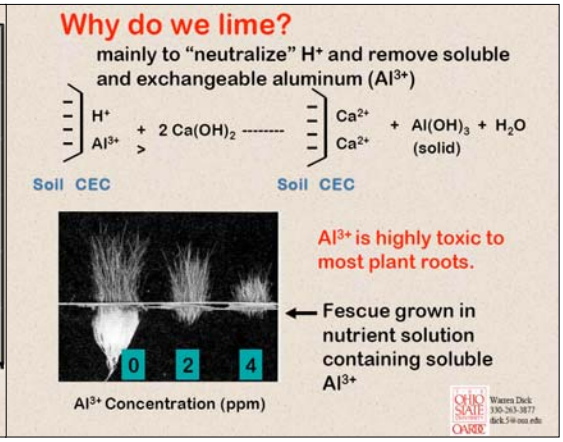
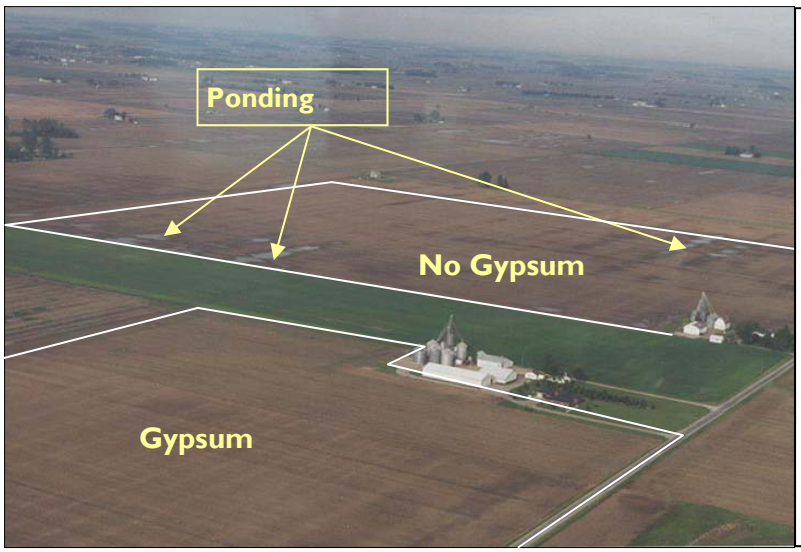
"Both President Thomas Jefferson and Benjamin Franklin were early American agriculturalists who saw the value of using gypsum. Actually, Franklin applied gypsum to a hillside near Hershey, PA to read prominantly in green 'This Hill has Been Plastered' an early name for gypsum, hence, the name "land plaster".

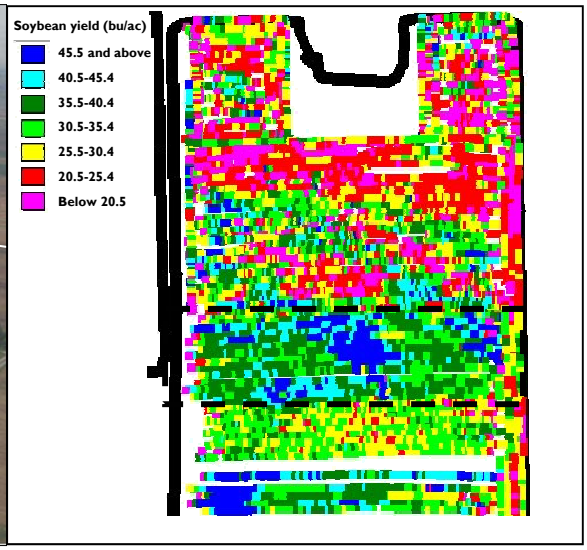




- Gypsum is a soluble source of S for plants.
- Sulfur is important for protein formation in plants.
- Studies (see above) from Dr. Warren Dick of the Ohio State University, Wooster, Ohio show S in rainfall has been greatly reduced since the late 1970's
- These same studies show a yield increase in corn from S fertilization.
- This leads to reduced erosion and improved water use efficiency that is well documented in the scientific literature and leads to increased available water and crop yield as shown in yield map below.
- "The greatest benefit of gypsum addition is on better water/air infiltration and drainage and stabilizing soil structure which results in decreased crusting.", L. D. Norton



Effect of Gypsum on infiltration/drainage on a Paulding clay.



Soybean yield with 1t/a surface applied gypsum in 2005 on Blount complex field. Treated area inside black dashed line.

January 2006