

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**AMENDING SOIL PROPERTIES WITH GYPSIFEROUS PRODUCTS**

(Ac.)

CODE 801

**DEFINITION**

Using gypsum (calcium sulfate dihydrate) derived products to change the physical and/or chemical properties of soil.

**PURPOSE**

- Improve soil health by increasing infiltration and improving physical/chemical properties of the soil.
- Improve surface water quality by reducing dissolved phosphorus concentrations in surface runoff and subsurface drainage
- Ameliorate subsoil Al toxicity
- Improve water quality by reducing the potential for pathogens and other contaminants transport from areas of manure and biosolids application

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies where land application of gypsum products will be used to alter the physical and/or chemical characteristics of soil to help achieve one of the above purposes.

This practice does not apply to soils with CEC of less than 5, soils with pH of less than 5.8, soils with an extractable Mg less than 200 lb/ac, or organic soils.

To remediate sodic soils, use the conservation practice Salinity and Sodic Soil Management (Code 610)

**CRITERIA**

**General Criteria Applicable To All Purposes**

Use of this standard requires compliance with all applicable federal, state, and local laws and regulations. It is the responsibility of the amendment provider to insure that this requirement is met.

Flue gas desulfurization (FGD) gypsum that is produced by forced-oxidation wet systems after the removal of fly ash is acceptable for these uses.

Do not exceed annual application rates of 5 tons/acre for the purposes defined in this standard. Where needed according to use, a current soil test is to be used to plan the appropriate application rate of the gypsum products.

**Additional Criteria to Improve soil health by increasing infiltration and improving physical/chemical properties of the soil.**

Use Table 1 to determine the application rate of gypsum products when slow infiltration and percolation due to poor aggregation is caused by an imbalance between calcium and magnesium.

Gypsum may be applied to pastures anytime livestock are not present. Do not allow livestock re-entry until the gypsum products have been removed from the vegetation by rainfall/irrigation.

**Table 1: Gypsum derived product application rate determination to improve soil physical/chemical properties and increase infiltration.**

Cation exchange capacity (CEC) is an indirect indicator of clay and organic matter content of soil and is related to how adjustment is needed when certain cations are excessive or deficient. The saturation ranges in Table 2a represent optimal cation availability for good soil structure as well as plant and biological use.

**Table 2a:** Target ranges for base saturation of cations to improve soil chemical and physical properties.

<u>Base Saturation</u>	<u>Balanced</u>
Calcium	70 – 80%
Magnesium	10 – 15%

Of the cations listed, calcium and magnesium have the greatest impact on soil structure. Lower CEC soils that tend to be droughty would prefer calcium at the lower end of the range and magnesium to be at the higher end. Higher CEC soils tend to perform best with calcium at mid-to-high range and magnesium at the lower end of the range. (NOTE: Amendment tables based on electrical conductivity for addressing saline and sodic soils are not addressed in this standard.)

Table 2b lists recommended annual application rates based on CEC. Multiple applications at the recommended rates will improve soil chemical and physical properties in a reasonable time without creating soil nutrient imbalances. Once the ratios shown in Table 2a are achieved, application rates can be stopped until soil test values indicate otherwise.

**Table 2b:** Gypsum application rates to improve soil chemical and physical properties.

<u>CEC</u>	<u>Rate (ton/acre)</u>
<5	0
5 – 10	0.25-0.5
10 – 15	0.5-1
>15	1-2

**Additional Criteria to Improve surface water quality by reducing dissolved phosphorus concentrations in surface runoff.**

**General Use on High P Soils** – Apply no less than 1 ton/acre (as long as it meets the criteria in Table 1) broadcast on the soil surface when soil test phosphorus (STP) is greater than two times the “maximum optimum level” for crop production, or when the P Index rating for the field is **HIGH** or **VERY HIGH**.

**NRCS, Ohio**

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**Manure Application** – Broadcast no less than 1 ton/acre (as long as it meets the criteria in Table 1) of gypsum within 5 days after manure application or prior to the next runoff event, whichever occurs first. Mixing gypsum with manure prior to application is acceptable. **CAUTION:** Under anaerobic conditions, gypsum added to liquid manure storage facilities can result in dangerous levels of hydrogen sulfide emissions and mixing or agitation cannot be conducted indoors.

#### **Additional Criteria to Ameliorate Subsoil Al Toxicity**

When exchangeable aluminum below a 12-inch soil depth is greater than 1.0 meq/100 mg soil, apply gypsum at a rate recommended by the Land Grant University (LGU) or the Agricultural Research Service (ARS).

#### **Additional Criteria to Reduce the Potential for Pathogen Transport.**

Apply no less than 2 tons/acre (as long as it meets the criteria in Table 1) of gypsum within 5 days after manure or biosolid application, or prior to the next runoff event after manure application, whichever occurs first.

### **CONSIDERATIONS**

#### **General Considerations.**

Gypsum should not be applied in watersheds where sulfate additions are restricted.

If soil pH is less than 5, the application of products with high sulfite content may be harmful to plants that are present at the time of application.

Long-term use of gypsum or using rates higher than given in the criteria can have adverse impacts on soil or plant systems. This can include:

- Creating a calcium imbalance with other mineral nutrients such as magnesium and potassium.

Additional Considerations for Improve soil health by increasing infiltration and improving physical/chemical properties of the soil. There is some research that shows gypsum application can increase crop rooting depth, total root biomass, and nitrogen uptake.

#### **Additional Considerations to improve surface water quality by reducing dissolved phosphorus concentrations in surface runoff**

Increasing the gypsum application rate beyond that set in Criteria will provide an additional decrease in dissolved phosphorus loss. However, the additional decrease at rates above 2 tons/acre is not proportional to the additional cost.

### **PLANS AND SPECIFICATIONS**

Plans and specifications shall be prepared for each field site where Gypsum Products will be applied. Record practice specifications on the (801) Amending Soil Properties with Gypsum Products Implementation Requirement document. Plans and specifications will include:

- The source of the product, e. g., flue gas desulfurization, mined
- Purpose(s) for its use and the planned outcomes.
- Soil analyses that demonstrate the need for the amendment
- Application methodology, including rates, timing, sequence of application with other nutrient materials (i.e., manures, biosolids, fertilizers), mixing instructions when mixed with manure prior to field application

- Required soil and/or plant analyses after application to determine the effectiveness of the amendment as appropriate.

## **OPERATION AND MAINTENANCE**

Do not allow livestock access to stacked gypsum.

Do not resume grazing until rainfall or irrigation has washed gypsum off of the vegetation.

Do not apply gypsum after the soil test calcium level exceeds the maximum level established by the Land Grant University.

## **REFERENCES**

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