

**“Liquid
Gypsum”**
SOIL CONDITIONER

IMPROVING TURF QUALITY

The Management of Soil and
Water Quality Problems

FOR BETTER GROWTH
SOIL LOGIC PRO.



Table of Contents

Liquid "Gypsum"	
Introduction	4
Formulation	4
Highlights	5
Polyacrylamide (PAM)	6
Some Uses	6
Technical View	7
Symptoms of Problem Soils	8
Salts and Sodium	9
Recycled or Poor Irrigation Water	9
Application Rates and Methods	10
Liquid "Gypsum" Label	11
Frequently Asked Questions	12
General	12
Application Methods	13
Application Rates	13
Polyacrylamides	14
Preliminary Findings - CSU Research	15
Contact Information	16
Other Products	16

Liquid “Gypsum”

Liquid “Gypsum” is on the cutting edge, taking advantage of combining the chemistries of soluble calcium, wetting agents, soil penetrants and the latest in polyacrylamide technology to formulate a soil amendment that has no equal.

There is no other soil amendment, other than Liquid “Gypsum”, that has the ability to displace sodium cations quickly from cation exchange sites, replace them with the desired calcium cations, and then create a positionally stable aggregate structure all in one operation. The ingredients in Liquid “Gypsum” work synergistically to make all of this happen. The water soluble polyacrylamide in Liquid “Gypsum” coats the soil colloids—creating large, stable soil particles and making them a part of the permanent pore structure matrix. This creates the essential pore spaces in the soil which store water, nutrients, and air for optimal root growth.

**New Research
shows the calcium
in Liquid “Gypsum”
as top performer**

The Formulation of Liquid “Gypsum”

- The calcium in Liquid “Gypsum” is 350 times more soluble than dry gypsum allowing immediate soil reactions. Improved turf quality can be seen within weeks of initial application.
- New research showing the calcium in Liquid “Gypsum” as the top performer in improving turf quality
- The wetting agent/soil penetrant allow the material to penetrate hard crusted soils and aids in subsequent irrigation and leaching of salts,
- The water soluble polyacrylamide enhances the effect of the calcium inputs and will help maintain the pore space with a cement-like effect. The polyacrylamide also helps with soil permeability problems and aids in stabilizing the soil structure.
- Research shows that calcium and polyacrylamide used together increase the effectiveness of each other by three times.
- Three different chemistries together enable Liquid “Gypsum” to improve turf quality in different soil types and conditions.



Highlights of Liquid “Gypsum”

Immediate Improvement in Soil Structure.

The solubility of the Liquid “Gypsum” allows for immediate displacement of the sodium ion.

Maximizes the soil’s ability to leach salts.

With 3 different chemistries at work, Liquid “Gypsum” improves water and air movement through the root zone.

Balances the soil chemistry.

Liquid “Gypsum” will free up nutrients in the soil that were once ‘tied up’ and allow for more efficient use of fertilizers and chemicals. Most users notice an immediate green-up with days of application.

...combining the chemistries of soluble calcium, wetting agents, soil penetrants and the latest in polyacrylamide technology...

Benefits most soil types.

Even soils that show high levels of calcium can benefit from Liquid “Gypsum” due to the ‘unavailability’ of the calcium in the soil.

The perfect solution for recycled water.

Unlike other calcium products, Liquid “Gypsum” also has a water soluble polyacrylamide that enhances infiltration and soil permeability allowing quality turf to be grown using poor irrigation water.

Increases root growth.

With the improved soil structure and pore space, root growth is dramatically increased. This is especially beneficial in the turf’s ability to withstand stress such as drought or high use areas.

Reduced Water Requirements.

The use of Liquid “Gypsum” will decrease soil crusting and allow for better water infiltration. Also, the removal of salts will allow the plant to take up the available soil water.

... to formulate a soil amendment that has no equal.

Top Performing calcium carrier in recent on-going research study. After 2nd year of 3 year study, study shows not only sodium displacement but the only calcium carrier that shows improved turf quality.

Polyacrylamide (PAM)

Liquid "Gypsum" contains several ingredients that work together in a synergistic manner to create a unique soil conditioner. The water soluble polyacrylamide also known as PAM plays an important role in how Liquid "Gypsum" amends the soil. The water-soluble PAM reacts with the clay in soil to flocculate it into larger soil particles that create better aeration, better water movement, less erodible soil, and many other benefits.

PAM does one simple thing. It stabilizes soil structure by attaching itself to the clay particles in soil. Actually, one molecule of PAM will attach to many particles of clay so that the clay becomes more "aggregated" or "flocculated." The stabilized soil means easier entry of water and air and better exit of excess water and spent air.

PAM's Effect on Soil Structure

- Binds soil particles together
- Prevents dispersion of small clay particle due to raindrop impact
 - Results in more stable soil structure, increased infiltration and reduced surface runoff
- Has been shown to be more effective in the presence of electrolytes (i.e. Ca^{2+})



PAM 101



Some Uses of Liquid "Gypsum"

- **Golf Courses.** Used on greens and tees to enhance downward movement of salts and maintain balanced soil chemistry. Added to recycled irrigation water to prevent build-up of detrimental salts.
- **Sports fields.** Used to maximize root growth so the turf is able to withstand overuse and compaction stresses.
- **Sodic Situations.** Liquid "Gypsum" can be used at high rates to quickly amend problem soils. For best results, follow with leaching program.

Technical View

Liquid "Gypsum" contains three primary ingredients intended to attack the monovalent sodium cations binding clay platelets together. The liquid calcium chloride in it contains 120,000 ppm of free exchangeable divalent calcium cations (compare to about 1,000 ppm in dry gypsum.) This cation exchange is based on the Law of Mass Action, which states that in order to drive this chemical reaction in a soil environment one must apply an overwhelming number of calcium cations to displace the large numbers of sodium cations attached to the negative exchange sites on clay platelets. This reaction is

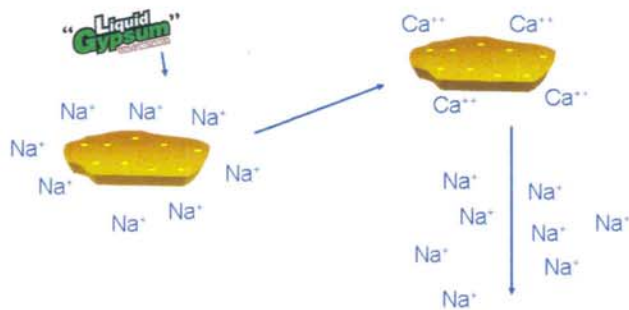
Liquid "Gypsum" is 350 times more soluble than dry gypsum

instantaneous, which is why Liquid "Gypsum" works quickly. It is also reversible, which means that if a water source is used for irrigation a constant source of sodium and other salts are constantly being reapplied. That is the reason there are two other ingredients.

To enhance this rapid reaction with sodium Liquid "Gypsum" also contains a high quality soil penetrant/humectant to help it penetrate resistant soils. The third ingredient is a water soluble polyacrylamide which, after the soil aggregate structure is flocculated, imparts a permanent status to the new aggregates, similar to gluing tiny clay particles into larger sand-size particles. This permanent status will last one to two years and prevents the clay cation exchange sites from being made available to passing sodium ions. Eventually, microorganism activity decomposes this aggregate structure, so period applications should be made based on percolation rate testing.

When the soil aggregate structure is stabilized into a better condition sodium and other salts, especially where recycled irrigation water is used, are more easily moved through the soil profile and past the root zone. Air is more easily drawn into the soil matrix enhancing macro and microorganism activity. Soil matter is more easily decomposed and humus formation moves forward.

The improved soil structure created by Liquid "Gypsum" allows the displaced sodium and other salts to be easily leached through the soil profile



Symptoms of Problem Soils

- Physiological drought—Plants are unable to take up available water due to high salts
- Salts can be seen on top layer
- Tendency to form hard, dense surface crusts, and “slick”, muddy spots
- Increased potential for run-off and erosion
- Crusting on the soil after rain or irrigation.
- Reduced rates of water infiltration and drainage
- Tendency for compaction
- Reduced movement of fertilizers and pesticides
- Increases in turf disease and pest activity
- Excessive cracking of the soil

In all but the sandiest soils, dispersed clays plug soil pores and impede water infiltration and soil drainage. This is usually attributed to the amount of sodium in the soil and can be worsened by poor water quality. A calcium amendment is universally recommended to combat this problem.



Before



Increasing soluble calcium flocculates dispersed clays which increases pore space. The improved soil structure allows better water infiltration, less compaction, and maximizes the soil's ability to leach salts.

The calcium in **Liquid Gypsum** is about 350 times more water soluble than traditional dry gypsum.



After



Salts and Sodium

Due to its destructive effect on soil structure, sodium is by far the worst salt present. A high level of sodium destroys the physical structure of soil by "blocking" the pore space in the soil. Excess sodium in the soil causes the soil aggregate to deflocculate or disperse into smaller aggregates which then decreases the pore space and causes the structural breakdown of fine-textured soils and even plugging of the pores of coarse-textured soils. This greatly reduces water movement in the soil, soil aeration and root growth.

Sodium affected soils are quite often composed of dense layers of dispersed clay that are usually impenetrable to plant roots, air and water. This may lead to compaction and resulting poor turf cover and plant health. Additionally, other salts present within the soil cannot be drained or leached away due to this "blocking" or deflocculation of the soil. Salt affected turf and plants often suffer physiologic drought where the soil has sufficient water content but the roots are not able to use the available water due to the sodium content in the soil. Often turf managers attempt to overcome the physiological drought symptoms by increasing water and applying fertilizers.



Recycled or Poor Irrigation Water

Recycled water use has helped to address the potable water shortages in many areas, but using recycled water poses a whole new set of turf management challenges. Water quality tests have shown that reclaimed water has higher salts and especially higher sodium levels. As time goes by the existing soil condition will continue to worsen and will visually manifest itself in a decline in quality of turf and ornamental plants. High clay content soils will begin to develop crusting on the surface and hardpan formation 3 to 6 inches below the surface, both of which will be detrimental to turf growth.

This degradation can actually be documented by soil testing every 6 months and observing the change in the Sodium Absorption Ratio (SAR) (or the Exchangeable Sodium Percentage - ESP) and the Base Cation Saturation Levels (BCSR). Sodium will become the dominant cation in the soil chemistry and, when it does, plant die back will quickly follow.

In order to rebalance the soil chemistry, it will require the introduction of a high calcium electrolyte (calcium chloride is the preferred material) in a high-enough concentration to drive the soil chemistry reactions in the desired direction, namely an increase in calcium ion concentration. This is called The Law of Mass Action. When this is done, the soil chemistry will fairly quickly move back to the desired balance between the important cations measured in the BCSR (Ca, Na, K, and Mg). The trick then is to manipulate the soil chemistry so that the soil structure remains stable for plant growth. Soil Logic Pro's Liquid "Gypsum" will do this quickly and effectively.

Application Rates and Methods

General Soil Conditions

For optimal results the condition of the existing soil structure should be addressed. Using soil testing and following the well established parameters for SAR, ESP and BCSR will provide a starting point. Other signs of poor soil structure is a lack of drainage, compaction and physiological drought.

1. Initially, apply Liquid "Gypsum" monthly at 32 oz. / 1000 sq ft. until desired soil structure is attained. Heavy clay soils might require more calcium to overcome the sodium and a double rate of Liquid "Gypsum" is then recommended for initial applications.
2. Depending on the quality of the irrigation water, 1-3 applications of Liquid "Gypsum" per year will be required to maintain soil structure. Precise calculations can be done using water analysis and soil testing if desired.

Recycled Water Use

Continued use of recycled water will destroy this new soil structure unless it is protected. This can be done two different ways.

1. By injecting a smaller amount of Liquid "Gypsum" into the irrigation water to change the water SAR; this is called buffering the sodium load. If enough free exchangeable calcium is in the water stream sodium will never have a chance to displace calcium on the soil cation exchange sites.
2. By applying 2-3 applications per year of Liquid "Gypsum" by conventional methods. Due to the negative impacts of using recycled water, this maintenance protocol must become a permanent part of the overall maintenance operation, but it will result in a very good soil quality for growing turf and ornamentals.

Liquid "Gypsum" is effective any time of year and can be used on both cool and warm season grasses. It can also be applied directly on bare soil or in planting holes.

Liquid "Gypsum" can be applied through conventional hose-end, hand-held, or boom sprayers. Fertigation or injection can also be used. Because it is a liquid formulation, there is no clogging of screens or filters and agitation is not required.

After conventional application, irrigate to move Liquid "Gypsum" into the soil profile. Although Liquid "Gypsum" will not burn or damage grass blades, the faster it gets into the soil, the faster it will start to work.

Rates and Coverage

Normal rate (1 quart/1000 sq. ft.)

<u>AMOUNT</u>	<u>AREA COVERED</u>
1 GAL.	4000 sq.ft.
2.5 GAL.	10,000 sq.ft.
11 GAL.	1 acre
55 GAL.	5 acres

Heavy rate (2 quart/1000 sq. ft.)

<u>AMOUNT</u>	<u>AREA COVERED</u>
1 GAL.	2000 sq.ft.
2.5 GAL.	5,000 sq.ft.
11 GAL.	1/2 acre
55 GAL.	2.5 acres

Commercial Label



Liquid "Gypsum"™

General Information

Liquid "Gypsum" is a liquid formulation of calcium chloride, surfactants, penetrants, and a water soluble polyacrylamide that remedies sodium and/or salt problems, clay and compacted soils, soggy soils and water drainage problems, soil erosion, and problems associated with poor or reclaimed irrigation water. Liquid "Gypsum" can also be used in seeding applications.

Liquid "Gypsum" is safe to use on all warm and cool season grasses, including golf course greens. It can be applied to bare ground and ornamental plants and can be used any time of year except when the ground is frozen.

Directions for Use

Turf – Apply 32 oz. of Liquid "Gypsum" per 1000 sq. ft. in sufficient water to apply material evenly over application site. Water after application to move the material into the soil. Apply monthly until optimal soil condition is obtained. Annual or bi-annual treatments may be needed for continued maintenance of the soil. For faster results, the application rate can be doubled or tripled. Liquid "Gypsum" can be applied by broadcast sprayer, hand sprayer, or fertigation system.

Shrub and Tree Plantings – Mix 2 oz. of Liquid "Gypsum" per gallon of water. Pour 16 oz. of the mix in the planting hole for each gallon size of the tree.

Seeding Applications – After seed has been broadcast apply Liquid "Gypsum" as it would be applied to turf. Its use will hold the seed in place and help prevent erosion.

Liquid "Gypsum" is not compatible with products containing sulfates or phosphates.

For maximum soil moisture management, use Soil Logic Pro's DROUGHT DEFENSE in conjunction with Liquid "Gypsum".

1 Gal. 2.5 Gal. 55 Gal. 275 Gal.

Fast-Acting, Long Lasting Soil Conditioner

Contains:

90% Calcium Chloride Solution
1% Polyacrylamide
1% Wetting Agent
8% Inert Ingredients

Conditions of Sale

Seller warrants that this product is made up of the ingredients as shown above and is reasonably suited for the purpose stated on this label when used under normal conditions and in accordance to directions on this label. No one, other than an officer of Seller is authorized to make any directive, guarantee or warranty concerning this product.

CAUTION:

Not for human consumption; may be harmful if swallowed. If swallowed, have victim drink water or milk. Never give milk to an unconscious person. If splashed in eyes— flush with water for at least 10 minutes.

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Soil Logic Pro

Based in Carlsbad, California, Soil Logic Pro provides innovative, high quality products to all sectors of the green and turf industries including homeowners with the retail Soil Logic line. The uniquely effective product line is based on science and cutting edge technology.

Contact Information

For questions concerning Liquid "Gypsum" or other Soil Logic Pro products, please contact:

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Other Available Products

Drought Defense (Soil Moisture Management)
Reduce irrigation times, hydroseeding additive

Moisture X-Tend (For container and potted plants)
Reduce watering frequency

Dust Down
Natural Oil Dust Control for roads, parking lots,.....

Liquid Binder
Hydroseeding, Erosion Control, Dust Control

On-Track
Specially formulated dust control for dirt race tracks