Incitec Pivot Fertilisers

AGRITOPIC

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GYPSUM

1. INTRODUCTION

Gypsum is the common name of hydrated calcium sulfate, which has the chemical formula $CaSO_4.2H_2O$. Gypsum is mainly used as a soil ameliorant to improve the structure of sodic and magnesic soils. Gypsum may also be used, at lower rates, as:

- a sulfur fertiliser;
- a calcium fertiliser.

Gypsum is sparingly soluble. A fine particle size helps gypsum dissolve more quickly in the soil, but this is not as critical as it is for lime. Gypsum has little if any effect on soil pH. It cannot be used as a substitute for lime to correct soil acidity, i.e. to raise the pH.

While sparingly soluble, gypsum is one of the more soluble calcium compounds. It is over 100 times more soluble in water than calcium carbonate or lime (at neutral pH of 7), but much less soluble than calcium nitrate or calcium chloride, which are used in fertigation programs and as foliar fertilisers.

Gypsum contains sulfur as sulfate, the form taken up by plant roots. The sulfur in gypsum is therefore readily available, so that gypsum can be used where a quick response to sulfur is required.

2. OCCURRENCE

Naturally occurring gypsum is a fairly soft crystalline mineral which is found in arid inland areas of Australia. Depending on the type and amount of impurities present, naturally occurring gypsum ranges from white to yellow, through pink to brown in colour. Pure gypsum is white.

Naturally occurring gypsum was probably formed by the reaction of sulfates on limestone in streams. The gypsum was washed downstream and deposited in remnant waterholes and as the water evaporated and the material dried, it was blown into knolls by turbulent winds in sunken gullies. In Australia, the workable deposits generally occur as discrete knolls or dunes on the eastern side of well-defined depressions. Other deposits are related to dry ancestral rivers and prior streams.

Deposits vary from a few centimetres to several metres in depth. The purity of these deposits varies greatly. Impurities include clay and sand, and the amount of each component is usually dependent on the site of deposition and the conditions prevailing at the time of deposition. The gypsum content usually varies between 35% and 85%.

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Gypsum deposits occur in western and southern New South Wales and north western Victoria, where commercially developed deposits are mined by open cut. Few deposits are mined in Queensland except in the north of the state. In western Queensland, natural deposits occur along the flood plains and associated dunes of the Jordan, Blackwater, Diamantina, Mayne and Mulligan Rivers.

Many soils in arid areas contain small deposits or nodules of gypsum throughout their profiles, i.e. at depth in the sub-soil. This most commonly occurs in heavy-textured clay soils. Responses to sulfur are unlikely on such soils. Should they occur, they are likely to be early in the growing season before the plant roots access the gypsum at depth in the soil.

3. PHOSPHOGYPSUM

Phosphogypsum is the name given to by-product gypsum produced during the manufacture of high analysis phosphorus fertilisers, e.g. DAP and MAP. Up to 1990, Phosphogypsum was produced at manufacturing facilities at centres such as Brisbane (Gibson Island) and Newcastle (Kooragang Island), and continued to be used in agriculture for some time afterwards. These stockpiles have now been exhausted, and Phosphogypsum is no longer available. Phosphogypsum continues to be produced at Incitec Pivot's manufacturing facility at Phosphate Hill in north-west Qld, but this site is too logistically remote to allow the phosphogypsum be considered for use in agriculture.

4. OTHER GYPSUM PRODUCTS

The supply to the industry of recycled plasterboard products has become available in recent years, due to the need for more responsible waste disposal techniques that reduce landfill and increase sustainability by reusing raw materials.

The coarseness of particle sizes varies by price point and level of refinement, but most are of a quality suitable for agricultural or mining rehabilitation applications. A level of organic materials (paper) are inevitable with these products. However, the buyer should be aware of other potential contaminants (metals, timber, builders waste) that may be present in some of these products. The products are mechanically screened and limit contaminants to around 1-2%.

Accurate and recent grade and sizing and contamination information should be sought from suppliers and distributors when considering suitable gypsum products.

5. COMPOSITION AND LABEL INFORMATION

5.1 Analysis

Pure gypsum ($CaSO_4.2H_2O$) contains 18.6% sulfur (S) and 23% calcium (Ca). Under state legislation in Australia, gypsum is categorised into a number of grades depending on its purity. The minimum concentrations are:

- Grade 1 > 15% S > 19% Ca
- Grade 2 > 12.5% S > 15% Ca
- Grade 3 > 10% S > 12.5% Ca

5.2 Sizing

A fine particle size is important for products that are insoluble or have low solubility. The percentage of the gypsum that is capable of passing through a 2.0 mm sieve must be stated on the label.

This is larger than for lime. For comparative purposes, the particle size criteria to determine fineness for lime has been set at 250 µm (micron), or 0.25 mm. Coarse gypsum takes longer to dissolve, which may be either advantageous or disadvantageous, depending on the circumstances.

A fine particle size may be of importance where gypsum is dissolved in irrigation water, it is used as a soil ameliorant, or a quick response is required. On the other hand, the responses obtained when fine-grade gypsum is used as a sulfur fertiliser may not be as long-lived on light textured soils in high rainfall areas where sulfate is leached.

The solubility of gypsum and other calcium salts used in agriculture are shown in the following table.

Solubility of various calcium salts in water at 20°C, unless otherwise specified.

Common name	Chemical name	Formula	Solubility (kg/100L)
Lime (calcite)	Calcium carbonate	$CaCO_3$	0.0014
Burnt Lime	Calcium oxide	CaO	0.13^{25}
Slaked Lime	Calcium hydroxide	$Ca(OH)_2$	0.17
Gypsum	Calcium sulfate	$CaSO_4.2H_2O$	0.26
Dolomite	Calcium magnesium carbonate	$CaMg(CO_3)_2$	0.032^{18}
Calcium chloride		$CaCl_2.6H_2O$	74.5
Calcium nitrate		$Ca(NO_3)_2.4H_2O$	84.5^{18}

Source: Lange's Handbook of Chemistry,13th Ed.

Some laboratories offer gypsum testing as part of their lime, dolomite and gypsum suite of analytes. Such analysis can be informative to the farmer or advisor when establishing quality and effective application rates of various products.

6. USES OF GYPSUM

Gypsum can be used as a fertiliser, to supply sulfur (S) and/or calcium (Ca); or as a soil conditioner. It may also be used to improve the infiltration rate of low conductivity irrigation water, and for water clarification.

6.1 Use of Gypsum as a Sulfur Fertiliser

Given its low analysis, it is usually uneconomical to use gypsum as a sulfur fertiliser if it has to be transported over any great distance. Its use is usually restricted to those districts in which gypsum is available locally at competitive prices.

Normally, sulfur is applied along with other nutrients, e.g. nitrogen or phosphorus, so there is little demand for straight sulfur fertilisers. Examples are granulated ammonium sulfate (Gran-am), ammonium phosphate sulfate fertilisers (Granulock SS), single superphosphate (SuPerfect), and blends in which these products are used.

Fertiliser Analyses

Incitec Pivot Product	% N	% P	% S
Gran-am	20.5		24.0
Granulock SS	10.0	17.5	12
SuPerfect		8.8	11.0

Situations where gypsum may be applied as a sulfur fertiliser include:

- In legume-based pastures on basaltic soils with high phosphorus levels, where fertiliser phosphorus is not required and legumes are relied on to fix nitrogen.
- In canola, as a pre-plant application, allowing high analysis nitrogen and phosphorus fertilisers with a low sulfur content to be used at planting and during the growing season.

<u>Pasture</u>

In raingrown pasture where sulfur is the only limiting nutrient, gypsum can be applied at 75 to 200 kg/ha/annum, supplying 10 to 30 kg/ha S.

The rate will depend on the rainfall and stocking rate, the higher rates being used in the more favoured areas. Higher rates may be required under irrigation, though some irrigation waters are high in sulfur, negating the need for additional fertiliser sulfur.

Particle size can affect how quickly the pasture responds to gypsum, and the longevity of the response. The finer the particle size, the quicker the product will be to dissolve. Once dissolved, however, sulfate is subject to leaching if heavy rain is received in the weeks and months after application. The sandier the soil, the greater the likelihood of loss.

Elemental sulfur can also be used as a sulfur fertiliser in pasture on soils high in phosphorus. Before elemental sulfur is of use to plants, it must be oxidised to the sulfate form. This is a biological process, being performed by *Thiobacillus* bacteria in the soil. Warm moist conditions are required.

In alpine regions with a winter dominant rainfall, gypsum is preferred to elemental sulfur. In the summer, it is too dry for the bacteria, in the winter it is too cold.

Canola (and Other Crops)

Canola is more responsive to sulfur than grain legumes, and in turn cereal grain crops. In canola, a minimum of 25 – 30 kg/ha S is generally recommended where sulfur is low, i.e. at least 150 – 200 kg/ha of gypsum.

In sulfur responsive situations, it is recommended that sulfur be applied in the sulfate form, particularly if it is applied close to planting time (or at or after planting).

Notes

It is often necessary to apply gypsum at about 300 kg/ha (45 kg/ha S) as it may be difficult to get application equipment to operate properly and spread gypsum uniformly at lower rates, particularly if the product has a fine particle size. This rate may exceed annual sulfur requirements, but the use of gypsum may still be cost effective if it can be sourced locally.

If gypsum is applied at high rates as a soil conditioner, e.g. 2 – 10 t/ha, there will be no need to apply additional sulfur in the fertiliser program for many years.

In heavy textured clay soils in semi-arid regions, i.e. many parts of inland Australia, sulfur may be low in the topsoil, but gypsum accretions or nodules may be present at depth (in the subsoil). A small amount of starter sulfur is all that is required in these circumstances, to satisfy plant demands in the seedling stages until such time that the crop roots have reached the subsoil. In these circumstances, it is customary to apply a low rate of sulfur in the planting fertiliser.

6.2 Use of Gypsum as a Calcium Fertiliser

Gypsum may be used as a calcium fertiliser, but often it will not be the product of choice. Calcium fertilisers, and where they might be used, include:

Lime

Lime should be used on acid soils that are low in calcium. Not only does lime supply calcium, it also corrects acidity (raises the soil pH). Lime has a higher calcium content than gypsum and it typically costs less kg of calcium.

However, while lime reacts in acid soils, it is ineffective in neutral and alkaline soils. Its dissolution in the soil is dependent on the presence of hydrogen ions (that are present in high concentrations in acid soils). Lime has poor solubility above a pH of 6.5.

Occasionally, the soil will test low in calcium and the pH will be found to be in the optimum range, indicating that calcium is required as a nutrient, but not as a soil ameliorant to raise the pH. Gypsum may be used in these circumstances.

However, before deciding on what action to take, it is important to check on what use has been made of lime in the past.

Light textured sandy soils in a high rainfall coastal area are naturally acidic. Lime is required on these soils as part of a balanced fertiliser program if high rates of nitrogen fertiliser are applied or legumes are grown. If the pH tests close to neutral where lime has been applied regularly in the past, it does not mean that lime no longer needs to be applied, and that some other product should be used in its place. Lime will continue to be required to maintain the status quo. If lime is not used, the soil will once again become acid.

There may be circumstances where calcium is required, and the pH needs to be maintained in the acid range. For example, the efficacy/longevity of some agricultural chemicals may be reduced at high pH.

Some root diseases may also be more prevalent under alkaline conditions, e.g., In potatoes, the incidence of the fungal disease Powdery Scab increases above a pH of 5.5. Lime should not be used in these situations if the pH is already above the critical value, or its use is likely to raise the pH above this figure.

Gypsum

A typical rate at which gypsum is applied as a calcium fertiliser where the pH does not need amending is 1 – 2.5 t/ha. This would normally be applied during the fallow period and can remain effective for several years.

In some soils and regions, subsoil acidity has developed at depth in the profile. While gypsum has little or no effect on soil pH, and lime is required to correct soil acidity, lime is slow to react and move into the soil. If the sub-soil has a low calcium status and this is affecting root growth and the utilisation of soil moisture and nutrients at depth, there may be a role for gypsum to increase the calcium status of the soil at depth. The calcium it provides will move more quickly into the soil than most grades of pulverised lime. It may be advantageous to apply both gypsum and lime, gypsum far a quick response, lime for long term amelioration.

Gypsum can also be used where a quick response is required to soil-applied calcium. Lime is unsuitable for use in these situations.

One such example is peanuts on sandy soils, where gypsum is often applied over the row after planting. Some plants, including peanuts and subterranean clover, absorb calcium directly into the seedpod from the soil.

Superphosphate

Superphosphate is not used as a calcium fertiliser. It is used as a phosphorus fertiliser, the rate at which it is applied being dictated by the phosphorus requirements of the crop.

There are circumstances, however, where the use of superphosphate at high rates may supply sufficient calcium to meet crop demands.

Note. Incitec Pivot SuPerfect is high in cadmium compared to high analysis fertilisers such as Incitec Pivot DAP. SuPerfect must not be used as the sole source of phosphorus in vegetable crops. Further information is provided in the Incitec Pivot Agritopic on “Managing Cadmium in Vegetables”.

Calcium Nitrate

Calcium nitrate is quite expensive compared to products such as gypsum and lime, but it is highly soluble. Calcium nitrate is used to prevent calcium deficiency in high value horticultural crops. It is used to prepare concentrated calcium solutions for injection into irrigation lines and for foliar sprays.

6.3 Use of Gypsum as a Soil Conditioner

6.3.1 Causes of Poor Soil Structure

Poor soil structure can be attributed to many factors, such as over-cultivation, compaction and a loss of soil organic matter. It may also be associated with high concentrations of sodium and/or magnesium in the soil, compared to calcium.

When soils with high exchangeable sodium are wet, the clay particles disperse, and the soil loses its defined crumb or pedal structure. This results in:

- Reduced aeration.
- Reduced water infiltration rates and storage.

- Increased run-off and soil erosion.
- A resultant reduction in the quantity of available soil moisture for plant growth.
- Root growth and exploration is restricted, as is the ability to take up essential plant nutrients.
- As the soil dries out after rain or irrigation, it sets hard and a surface crust is formed. This makes the soil difficult to cultivate.
- The surface crust formed on drying often inhibits seedling emergence if rain falls between planting and emergence. Poor crop stands can result.

Soil structural problems are not limited to surface soils. In some areas, light textured topsoil with good structure may overlie dense impermeable clay subsoil with associated water and root penetration problems.

In soils dominated by calcium, the clay particles aggregate and form crumbs. These are much more stable than sodium saturated clays that disperse on wetting. The soil swells less, and the larger soil pores and cracks persist during wetting. As a result, the soil is better aerated, and has better water infiltration rates and internal drainage. More water enters and can be stored in the soil.

Calcium dominated soils are described as self-mulching. The surface remains friable and does not form a hard crust on drying. The soil is easier to cultivate, while plant roots find it easier to explore the soil for moisture and nutrients.

While not as deleterious as sodium, soils high in magnesium display similar characteristics. They are puggy and have poor drainage, and remain blocky or cloddy after cultivation under some moisture conditions.

The structure of sodic and magnesic soils (soils high in sodium and magnesium) can be improved by applying calcium compounds such as gypsum (calcium sulfate) at high rates. As the gypsum dissolves, it releases calcium ions that displace sodium (or magnesium) on the clay colloids.

Good rainfall (or irrigation) and drainage is necessary to leach the displaced sodium (and magnesium) from the topsoil deeper into the soil profile. If drainage is poor, movement away from the root zone of displaced cations will be low, resulting in sometimes toxic or concentrated bands in the soil profile.

<u>Note</u> – Sodium and magnesium affect the behaviour of clay, but have no effect on raw sands. They have some influence on most agricultural soils, as there will always be some clay present, but the effects are most evident on heavy textured soils with a high clay content.

6.3.2 Recognition of Gypsum Responsive Soils

To start, much can be learnt from the field, e.g. degree of surface crusting, ease of cultivation, ability to store and use soil moisture, and crop yields.

Soil tests can further assist in confirming the cause of soil structural problems. The exchangeable cation percentages, in particular, those for sodium (ESP) and magnesium (EMgP), have been used with considerable success to assess if a soil might respond to gypsum. The Calcium:Magnesium ratio is also used to identify situations where high magnesium levels are adversely affecting soil structure.

The critical values discussed herein are more applicable to clays and loams than to sandy soils.

Note. In determining cation percentages and ratios, the soil test results must be expressed on a milli-equivalents basis (meq/100 g), not as mg/kg (ppm).

Exchangeable Sodium Percentage (ESP)

In many overseas reports, an ESP of 15pc has been considered to be the threshold at which sodicity restricts crop yield. Evidence from research in Australia however has indicated that sodic effects may appear at ESP levels as low as 4pc to 6pc on heavy clay soils.

Exchangeable sodium percentages (ESP) typically increase with depth. As a guide, soils might be described as being slightly, moderately or highly sodic according to the following criteria.

Sodicity Classification according to ESP within the profile

Classification	**Exchangeable Sodium Percentage**	
	Surface	**Sub-surface**
Slightly sodic	5	15
Moderately sodic	10	30
Highly sodic	15	40

Exchangeable Magnesium Percentage (EMgP)

High exchangeable magnesium also causes clay dispersion. An exchangeable magnesium percentage (EMgP) of 20pc in the top-soil has been suggested as a level above which clay dispersion may occur and soils respond to gypsum. The effects of expression can be exacerbated by the presence or absence of soil salinity, where very low levels (EC1:5

<0.1mg/kg) can see magnesium symptoms express compared to soils where EC1:5 is higher. Low rates (0.5-1t/ha) may be necessary to introduce a slat to ameliorate in certain circumstances. Please seek further advice.

Calcium:Magnesium Ratio (Ca:Mg)

Ideally, calcium should make up about 65 – 80% of the total cations, and the Ca:Mg ratio should be about 4:1. Soil structure is likely to be adversely affected if the Ca:Mg ratio is less than 2:1.

Clay Dispersion Index

The Clay Dispersion Index is used in some States to provide additional confirmation of the need for soil amelioration in soils dominated by sodium and/or magnesium. The dispersion of soil aggregates in water is studied, and depending on the degree of dispersion, are given a rating.

6.3.3 Gypsum Rates

The rate at which gypsum is recommended will depend on the soil type (higher rates are required on heavy clays), the severity of the problem, the depth of incorporation, and the value of the crop. High rates may be recommended where an irrigated crop is to be grown, whereas gypsum may not be recommended at all if raingrown pasture was being grown on the same soil.

Permanent Pasture

Where there is evidence of soil structural problems, test strip or apply gypsum at 2.5 t/ha. If the problem is severe, and in irrigated pastures, test strip at a higher rate, 5 t/ha.

Surface Crusting in Raingrown Grain and Forage Crops

Sometimes, gypsum is applied with the sole intent of reducing the severity of surface crusting, so that rainfall infiltration rates are improved, and crop emergence is improved in the event that rain falls in the days immediately after planting.

A typical application rate is 2.5 t/ha. A light harrowing after application helps prevent gypsum losses in the wind or surface run-off. The longevity of such applications will be greater under reduced tillage conditions. Cultivation mixes and dilutes the gypsum in the topsoil.

Improving the Tilth of the Soil to the Depth of the Plough Layer in Crops

Gypsum application rates will depend on the clay content of the soil, depth of incorporation and value of the crop. Higher rates are recommended in sugarcane, and irrigated cotton and vegetable crops than in raingrown grain crops.

Indicative rates, based on soil test results, are given below. These rates are not cumulative. Each test provides an estimate of the gypsum requirement in its own right.

A maximum of 10 t/ha of gypsum should be applied in any one application or year. Higher rates may be warranted in some situations, but it is best to wait a few years before re-applying gypsum.

Gypsum Rates (t/ha) at Various "Exchangeable Sodium Percentages" in the Topsoil.

ESP (%Na)	**< 5**	**5 - 15**	**> 15**
Rating	Low and Harmless	Medium	High
Loam – t/ha Gypsum	Nil	2.5 - 4	5 - 10
Clay – t/ha Gypsum	Nil	5	10

Clay Dispersion Index

Clay Dispersion Index	0 - 5	6 - 10	> 11
Gypsum (t/ha)	No action required.	2.5 - 5	5 - 10

Use the lower gypsum rates on light soils, the higher rates on heavy textured clay soils. Recommendations to apply gypsum where soil magnesium levels are high are less certain.

Given the amount of magnesium present in the soil (the concentration can exceed that of calcium), it is often impractical and uneconomical to attempt to replace most of it with calcium. Sometimes it is better to live with the problem, and manage it in other ways. A decision to apply gypsum should be based on field observations of the severity of the problem, as well as soil test values. Often it will be better to try a test strip to assess the likely benefits, before applying gypsum to the whole field.

Gypsum may be required once the Exchangeable Magnesium Percentage (EMgP) exceeds 20 – 25%. Soil Calcium:Magnesium (Ca:Mg) ratios can also be used to identify situations where magnesium may be affecting soil structure.

In Queensland and New South Wales, gypsum can be trialled or applied at 2.5 to 5 t/ha (if there is field evidence of soil structural problems) if the Ca:Mg ratio is less than 2:1. In the southern States (Victoria and South Australia), the following table can be used as a guide to appropriate gypsum rates on magnesic soils.

Suggested Gypsum Rates (t/ha) at Various Ca:Mg Ratios in Victoria and South Australia.

Ca:Mg Ratio	< 1.5	1.5 – 2.0	2.0 – 2.5	> 2.5
Field Crops	6	4	2	Nil
Horticulture – trees, vines & vegetables	7.5 - 10	5 – 7.5	2.5 - 5	

6.3.4 Gypsum Application

Gypsum is broadcast on the soil surface.

In **pasture** and **tree crops**, this can be done at any time, though it would normally be done in advance of the main growing season, i.e. autumn for clover based pastures, and in the late winter or spring in tree crops.

Where gypsum is applied to reduce the severity of **surface crusting** in rain grown crops, timing is not critical, but it is best applied soon after harvest. This:

- Avoids crop damage (from vehicular traffic if applied during the growing season),
- Maximises the amount of soil moisture stored during the fallow period, and
- Allows time for the gypsum to dissolve and improve the characteristics of the surface soil by the time the next crop is planted. Gypsum is sparingly soluble, so the earlier it is applied, the better.

Where gypsum is applied at high rates (above 2.5 t/ha) to **improve soil tilth** to the depth of the plough layer, it **must** be applied early in the fallow period (> 4-6 months prior to planting of the next crop). Following application, it should be thoroughly incorporated using cultivation into the soil to 10cm depth.

Gypsum improves soil structure by displacing sodium (and magnesium) on the surface of clay particles with calcium. Gypsum (calcium sulfate) is sparingly soluble, but the sodium (and magnesium) sulfates that form in the soil solution are very soluble. They add to the overall concentration of soluble salts in the soil. Rain (or irrigation) is required to leach these soluble salts out of the topsoil deeper into the soil profile, away from zone in which crop roots will be growing. If this does not occur, soil structure may be improved, but crop growth may in fact be made worse due to the salt effect. The earlier gypsum can be applied, the better.

Good internal drainage hastens the reclamation of sodic soil. Where drainage is poor, and it is practical and economic to install surface and sub-surface drains, e.g. tile drains, mole drains or slotted pipes, this should be done.

Note. Gypsum can also be applied with flood irrigation water where soil structural problems exist, or sodic or magnesic irrigation water is used. Gypsum with a fine particle size and a minimum of insoluble impurities is required at adequate rates. Liquid or pre-mixed formulations are marketed to offer favourable product claims under this use pattern, but often economic rather than agronomic considerations determine application rates reducing the effectiveness or duration of amelioration compared to bulk gypsum.

This is done in flood irrigated sugarcane in the Burdekin Irrigation Area in north Qld. The Bureau of Sugar Experiment Stations (BSES) has designed a Dissolvenator for this purpose. A typical gypsum addition rate is 0.8 kg/1 000 L of irrigation water. This equates to 800 kg/ML, or 800 kg of gypsum in each 100 mm of irrigation water that is applied.

Note. The maximum amount of gypsum that can be dissolved in water (to form a saturated solution) is 2.6 kg/1 000 L.

6.3.5 Before applying Gypsum to Sodic Soil, check the Soil EC (Electrical Conductivity).

Poor drainage is a characteristic of poorly structured soils. Salt tends to accumulate in such soils, and consequently, sodicity is often associated with salinity. The salinity status of the soil is determined by measuring the Electrical Conductivity. If a soil test reveals high electrical conductivity, sodium and chloride, gypsum should **not** be recommended. The best way to ameliorate the soil will be to improve drainage, as most of the sodium will be present as soluble sodium salts and not exchangeable sodium.

At more moderate EC levels, and where it may not be practical to improve drainage, gypsum should not be applied if a crop is to be planted into the area in the near future. It will be better to defer applying gypsum to some later time when the land can be fallowed for an extended period of time. Before a crop is planted back into the area, another soil test should be taken to check that the EC has fallen back to an acceptable level.

6.3.6 Use of Lime to improve Soil Structure?

Sodic and magnesic soils are typically alkaline, i.e. they have a high pH. Lime is insoluble and therefore ineffective if the pH is high. It only reacts in acid soil. In acid soil, the solubility of lime is adequate to supply calcium and increase pH. Gypsum has little or no effect on soil pH.

On soils that are both **acid** and **sodic**, lime should be used, or a combination of lime and gypsum. The gypsum will work quicker in improving soil structure than lime, but lime is necessary to increase the soil pH. Lime is of no use on alkaline sodic soils.

6.4 Use of Gypsum to Improve Irrigation Water Infiltration Rates

The use of low conductivity irrigation water can cause clay particles at the soil surface to disperse, causing the surface to seal, thereby reducing water infiltration rates. This can occur in soils of otherwise good structure.

Dissolving gypsum in flood irrigation water prior to its application will increase its electrolyte content or conductivity. This helps prevent dispersion and reduces sealing. As gypsum is sparingly soluble, the use of agitators in the mixing tank can help get it to dissolve.

6.5 Use of Gypsum as a Water Clarifier

Gypsum can be used as a clearing (or flocculation) agent for muddy water, e.g. from dams, bores and in rice paddies. It causes the very fine suspended colloidal particles to clump together, forming particles too large to remain in suspension, so they fall to the bottom.

A fine particle size is essential for the gypsum to dissolve quickly. A suggested application rate is 1 kg of gypsum per 5 000 litres of water.

WARNING

The information contained in this publication is for use as a guide only. The use of fertilisers and soil amendments are not the only factors involved in producing a top yielding crop or pasture. Local soil, climatic and other conditions should also be taken into account, as these could affect crop and pasture responses.

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