Water Problems Explained

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Water Problems Explained

Hard Water

Water is a great solvent, and dissolves minerals very easily. Pure water can be called the universal solvent. As water moves through soil and rock, it dissolves very small amounts of minerals and holds them in solution.

Calcium and magnesium dissolved in water are the two most common minerals that make water “hard”. The degree of hardness becomes greater as the calcium and magnesium content increases.

Symptoms of Hard Water

Hard water interferes with almost every cleaning task from laundering and dishwashing to bathing and personal grooming. If your water is hard you will undoubtedly be experiencing some or all of these symptoms:

- Clothes laundered in hard water may look dull and unwashed
- Dishes and glasses may be spotted and streaky when dry
- Film may be left on glass shower doors, shower walls, baths, sinks and taps
- Hair washed in hard water can be wiry and dry
- Reduced water flow caused by build-up in pipes
- Blocked irrigation sprinklers and drippers
- Blocked stock-trough float-valves

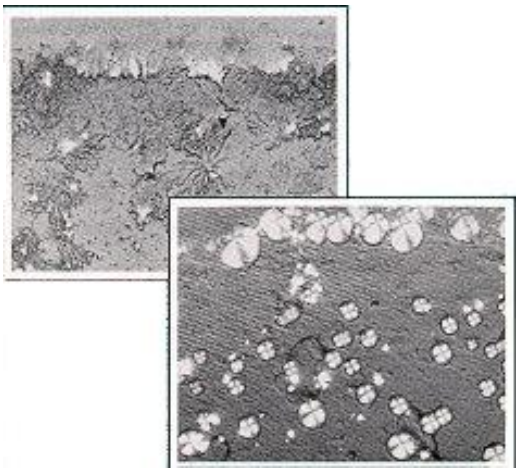
The amount of hardness in minerals in water affects the amount of soap and detergent necessary for cleaning. Soap used in hard water combines with the minerals to form a sticky soap curd.

Hard water also contributes to inefficient and costly operation of water-using appliances such as kettles and hot-water systems. Heated hard water forms a scale of calcium and magnesium minerals that can contribute to the inefficient operation or failure of water-using appliances. Pipes can become clogged with scale that reduces water flow and ultimately requires pipe replacement.

Treating hard waters with magnetic water conditioners

GrowFlow Magnetic Water Conditioners don't actually remove the calcium and magnesium from the water, but they DO render them technically inert. They lose their ability to bind and to set like cement. This means you will no longer get that scale build-up on everything that the water comes into contact with.

Microscopic photograph of unconditioned hard water showing "dendritic" crystal scale formation.



The same water after having moved through magnetic fields with nearly 100% effectivity.

Here are some of the benefits experienced by using GrowFlow Magnetic Water Conditioners to treat calcium and magnesium build-up in the water:

- Hot water elements don't wear out in a short time any more
- You can wash the car
- You can wash the windows
- No more scale formation and streaking on glass
- Water becomes soft and will easily form a lather

We have yet to encounter a hard water problem that we cannot treat!

Iron

Iron in irrigation and garden water

When bore water has iron levels in excess of 0.3mg/l installation of a GrowFlow Magnetic Water Conditioner tends to accelerate the oxidation of the dissolved iron to form iron oxide.

If this water is for irrigation only, magnetic treatment will prevent iron oxide build-up in the system as the change to the iron oxide molecule enables it to pass through the system without building up as a scale or blocking micro sprinklers or drip emitters.

The GrowFlow magnetic treatment also slowly breaks down any existing iron build-up in the system. This process can produce very small flakes. Because of this the problem of blocked drip emitters and micro sprinklers may get worse before improving.

For situations where no iron is tolerable, and simply must be removed, contact Solarain for details of the Purewater Ozone System. You can use oxalic acid to clean the stained areas.

Salinity and Sodicity (too much sodium)

These are two often-related areas… but not necessarily. Salt is NOT necessarily sodium chloride. That's table salt! Salts can be calcium carbonate, or magnesium sulphate, or many other combinations as well as sodium chloride.

Sodicity

High levels of sodium in soil (either occurring naturally or from high-sodium and/or high SAR waters) will make a soil SODIC. Sodic soils have a horrible dispersive, hard –setting and easily compacted structure.

Well structured soils have plenty of exchangeable calcium. Poorly structured, dispersive "sodic" soils contain high levels of exchangeable sodium where there should be calcium.

Calcium holds soil particles together, ensuring:

- stability
- root penetration
- water infiltration; and
- aeration

Sodium ions have only half the charge as calcium ions and therefore hold particles weakly… which means that the bonds fall apart, leading to:

- compaction
- poor aeration
- poor infiltration; and
- root penetration

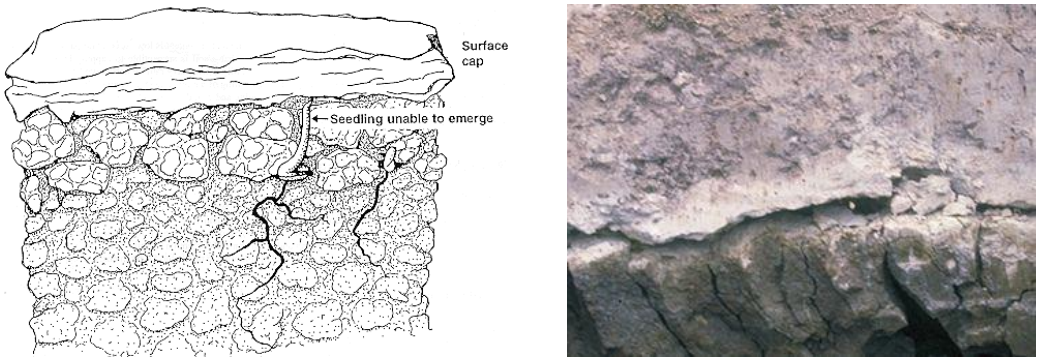
High levels of soil magnesium have a similar detrimental effect on structure. The solution is:

- replacement of calcium ions (commonly through gypsum)
- drainage (ripping); and
- leaching of sodium ions

Additions and maintenance of soil organic carbon will also assist in rebuilding healthy soil structure.

Treatment of Sodicity with the GrowFlow Magnetic Water Conditioner

Treatment with the GrowFlow Magnetic Water Conditioner dramatically reduces the build-up of sodium in the soil and will generally assist in leaching built-up soil sodium thus allowing the treated water to be used without detrimental results.



Sodic Soils

Salinity

Salinity is a different matter. Saline waters DO often contain high levels of sodium, therefore all of the above may well still apply. Your water test will show this.

Salinity will show up in your water test as a high EC (electrical conductivity). Read the article "How Plants Take Up Water" and note the point made about how it takes energy for the plant to take up water from the soil.

When there is salt in the water (or in the soil-water because of salty water and/or salty soil) it is extremely difficult for a plant to take a drink. The plant uses its energy from evapotranspiration to draw water from the soil. When there is salt present it becomes more and more difficult for the plant.

Water moves from the soil into plan tissues by osmosis (definition: "osmosis is the passage of water from a region of high water concentration through a semi-permeable membrane to a region of low water concentration").

Where there is salt in the soil and soil-water, the salt in the soil/water draws the water back to itself. Therefore the saltier the soil and soil-water, the less water is taken up by the plant. The plant is stunted. If it's very salty, it may eventually die of thirst.

The other important issue is this: when you apply saline water to the soil, much of this water evaporates. The water evaporates… the salt does not! Generally the more you use saline water, the higher the concentration of salts you will create in the soil. Whilst moderately saline water may not show immediate problems, it may well become a problem in years ahead.

Salinity in garden and irrigation water

High salinity levels will have detrimental effects in a number of areas.

- Initially, salt makes it more difficult for plants to withdraw water from the soil even if the soil appears to be quite moist. Salt attracts and absorbs the water competing with plants for available soil moisture, and as the available soil moisture declines, plants have to exert more energy to satisfy their water needs resulting in stressed wilted plants in what appears to be adequate soil moisture conditions.

- Salt accumulation on plant foliage after spray irrigation may burn the leaves.

- Sodium reacts with the soil to change the soil structure in a detrimental manner, reducing water movement (permeability) and aeration in the soil.

- As the plant root absorbs water from the soil it also absorbs the salts, plant foot etc, dissolved in it. High concentrations of salts taken up by the plant can damage the plant internally, having a toxic effect on the plants, affecting the plants physiological processes and often resulting in reduced and stunted growth, yellowing and death of the plants.

- High salinity will reduce the availability of some plant foods, for example, high levels of sodium or magnesium may induce calcium or potassium deficiencies in plants growing in soils low in these elements.

- There may be evidence of corrosion in metal pipes, plumbing, hot water systems, irrigation fittings etc.

- Stock may avoid drinking water having high salinity levels or at least have a reduced intake of water. This reduced intake of water and/or the presence of high levels of sodium and chloride may affect livestock's appearance, thrift performance and the females' milk production.



Treating salinity with GrowFlow Magnetic Water Conditioners

GrowFlow Magnetic Water Conditioners are used to treat all but the worst of saline waters (we will always tell you if we can't help you!). This treatment has consistently shown positive results both in plant growth and in soil test results.

The same osmosis issue applies when saline waters are applied to plant foliage, especially on the more sensitive crops. The water evaporates, leaving minute crystals of salt on the leaves. These salts will then draw moisture out of the leaves into themselves resulting in dead patches and spots on leaves… or even dead leaves or dead plants.

Again, the GrowFlow Magnetic Water Conditioners will prevent this happening in all but the worst of waters.

The following improvements can be expected when water with high salinity levels is treated with a GrowFlow Magnetic Water Conditioner:

- Changes to the water molecule reduce the surface tension of the water, allowing faster wetting and penetration of water into the root zone.
- The salts are changed to more harmless compounds with magnetic water conditioning, and they:
  - Do not affect the plant foliage
  - Do not change the soil structure
  - Are not toxic to sensitive plants
  - Do not alter the balance or availability of plant nutrients
- The changes to the water molecule, (as described above) result in a leaching action that will prevent salt build-up in the soil and assist in leaching and reducing soil salinity as a result of previous watering with this water.

Much of the information we have on the results we are achieving with the GrowFlow Magnetic Water Conditioners in controlling the damaging effects of salt in irrigation water on plants and soil is received by way of feedback from our customers.

It must be pointed out that these results depend on the level of salts in the water. In cases of high salinity not all plants can be grown, however treatment will allow a broader range of plants to be grown.

How do plants take up water

What the plant needs

Seems like a good place to start. It's all about the plants after all! Plants need water. We all know that. Why do they need water? For the following reasons:

- Firstly, plants need water in order to stand up. Some will eventually make woody tissue to help this process, but basically plants are full of pressurised water which makes them turgid. The leaves offer themselves to the sun… their stomata (pores) open… and moisture evaporates. Water is drawn upward from the roots and through the stems to replace this lost water. This process is called "evapotranspiration". The more sun, the greater the pressure to take up water. This process takes energy from the plant, and obviously requires a healthy root system and the presence of AVAILABLE water in the root zone (I'll explain the "availability" shortly). If it's not there, the plant will wilt. In cases of root disease and diseases like Fusarium, you will see whole crops crash down.

- Secondly, plants need water to carry nutrients into themselves which are dissolved in the soil water. They can't munch on dry fertiliser. No water… or I should say "no passage of water into the plant"… and no nutrient uptake. If the plant can't take up water, it will become starved of nutrients. It's not so uncommon to see high nutrient soils and pale, nutrient-starved crops because of an inability of the plant to take up water.

- Thirdly, plants need water to photosynthesize. To summarise a fairly complex process, photosynthesis is the synthesis of sugar (energy) from light, carbon dioxide and water, with oxygen as a by-product. Take away any of those factors, and the plant won't grow. It has no energy.

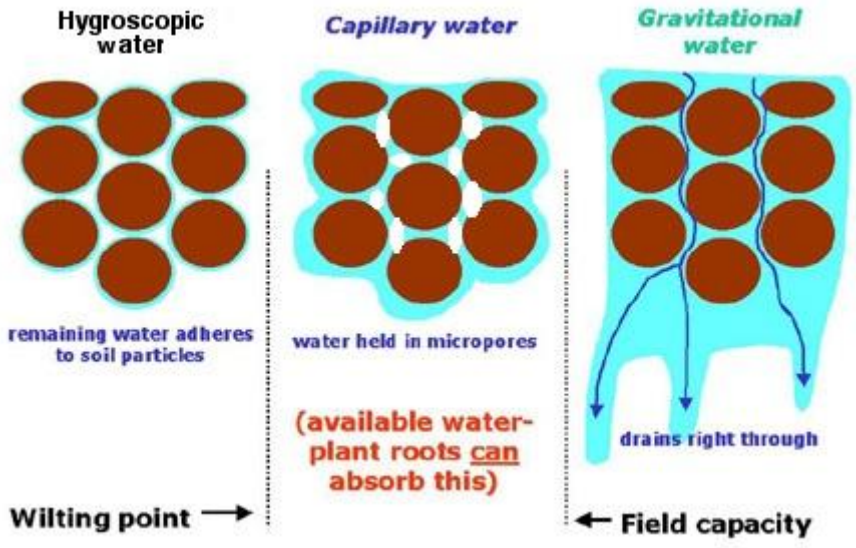
- What else do plants need? They need oxygen, and they need it in the root zone. Like all aerobic organisms (including us) they need to respire as part of the process of utilising the sugars they created in photosynthesis, and this requires oxygen. No oxygen, and no respiration. No respiration, and no functionality. The roots can't grow… and can't take up water… and can't supply the plant with the nutrients and water that it needs. This is why we talk about a plant needing DRAINAGE. The problem in a waterlogged situation is not too much water… it's too little oxygen!

Water in the Soil

Soil is made up of soil particles in crumb-form (peds), and pore spaces around the soil crumbs. In a well-structured soil these crumbs are nice and stable… but in a poorly structured soil the crumbs are unstable which often limits pore-space.

The pore-spaces are necessary for holding water and for the free gaseous exchange of oxygen and carbon dioxide between the plant roots and the soil surface (respiration process).

There are three types of soil water (i.e. water in the soil):



Gravitational water: this is the water which is susceptible to the forces of gravity. It exists after significant rainfall, and after substantial irrigation. This is the water which fills all the pore-space, and leaves no room for oxygen and gaseous exchange. In "light" soils this tends to drain away quickly. In heavy soils, this can take time.

Capillary water: this is the water which is held with the force of SURFACE TENSION by the soil particles, and is resistant to the forces of gravity.

This is the water which is present after the gravitational water has drained away, leaving spaces free for gaseous exchange. When the soil is holding its MAXIMUM capillary water (after the gravitational water has drained), this is called FIELD CAPACITY. At this point, the plant is able to take up water easily and has the oxygen that it needs in the root zone.

Hydroscopic water: this is the water which is held so tightly (by surface tension) to the soil particles that the plant roots can't take it up. It's there… but it's unavailable. At this stage there's generally sufficient oxygen, but there isn't enough available water. The plant wilts and will eventually die if it doesn't get water.

When the plant wilts and is unable to recover, this is called the PERMANENT WILTING POINT.

Now… a lot happens between field capacity and permanent wilting point. Try to understand this point:

The closer to the soil particle the water is held, the tighter it's held. And the further from the particle, the looser it's held. It takes little energy for the plant roots to take up the water that's far from the particle and is present at the field capacity point.

By contrast, as the water is used up (or evaporates), it takes more and more energy for the plant to take up water.

I often use the analogy of drinking through a straw. A short straw, i.e. when a cup is 15cm away from you, is easy to use. A one-metre straw takes a lot of energy to suck up a drink. A twenty metre straw is impossible to use.

It works much the same with plants. The more the soil dries out, the more energy the plant needs to output in order to get a decent drink.

Note that the effect of increased soil salinity (due to high soil salinity, high soil-water salinity, or both) has basically the same effect as a soil drying out.

Salt in the soil has an osmotic effect and causes the water to be held more tightly around the soil particles. The higher the salinity level the harder it is for a plant to take a drink, despite apparently sufficient moisture present.