Focus on Humectants

The Use of HYGROSCOPIC HUMECTANTS in MANAGING SOIL MOISTURE

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Most turfgrass managers are familiar with the use of wetting agents, or surfactants, and super absorbent polymers in managing water movement and retention in soils. However, there is another class of chemistry that is gaining acceptance in the management of turfgrass and ornamental soil moisture. This class of chemistry is referred to as hygroscopic humectants.

Before discussing hygroscopic humectants, it is important to understand how they differ from other water management technologies. First, wetting agents are chemicals that "reduce surface tension of water, allowing the water molecules to spread out" (Baird and Zublena). Another definition is "any compound that causes a liquid to spread more easily across or penetrate into the surface of a solid by reducing the surface tension of the liquid" (Zontek and Kostka). Therefore, a wetting agent is a material that allows water to more easily penetrate into soil and/or flow through (infiltrate) the soil. These materials are valuable when soils have become hydrophobic and will not wet easily.

Super absorbent polymers, another type of water management technology, are "materials that can absorb and retain extremely large amounts of liquid relative to their own mass" (Horie, et. al). These materials are utilized to absorb large amounts of rainfall or irrigation to be used by the plant at a later date. These materials are commonly used in greenhouse and nursery industries, as well as in some agricultural settings. However, the use of polymers in turfgrass is difficult due to two reasons. The first is that polymers are difficult to incorporate into the soil profile. The second is that, as they absorb water, they expand, and can disrupt the soil and turfgrass surface. However, there are some new developments in polymer technology that may overcome these challenges.

Hygroscopic humectants are materials that attract water vapor (the gas phase of water) from the atmosphere within the soil, condense it back into a liquid form, and retain the liquid for the plant to absorb. According to Merriam-Webster Dictionary, a hygroscopic material is any material that "readily takes up and retains moisture." Most turf managers are more familiar with hygroscopic materials than they may realize. For instance, many fertilizer ingredients are hygroscopic. It is the hygroscopic nature of some fertilizers that cause them to "cake" or form chunks in the package.

The definition of a humectant is "a substance that promotes retention of moisture" (Merriam-Webster). These are substances that absorb, or help another substance to retain moisture. These types of materials are commonly used in the food and cosmetic industry. For example, humectants will help keep food from drying out and becoming stale. In cosmetics they help keep different types of make-up pliable so they may be applied to the skin in an even fashion without causing dryness.

The key to successfully using hygroscopic humectants to manage soil moisture is utilizing the right combination of raw ingredients. Some raw materials will attract moisture and condense it, but will hold it too tightly, not releasing the water to the plant. On the other hand, some raw materials may compete with the plant for soil moisture and be detrimental to plant health. Finally, some raw materials will be broken down in the soil by microbes too quickly, and have a short-lived effect.

The best combination of raw ingredients are those that will attract soil water vapor to itself, condense it into a droplet, and then allow the plant root to remove that droplet for use in its metabolic activities. Another vital factor in the success of a hygroscopic humectant product is to have a certain resistance to microbial degradation. Many of the raw ingredients used in a hygroscopic humectant are organic in nature, and can be used by soil microbes as a food source. We see the same types of challenges in pesticide formulations.

Hygroscopic humectants have a variety of uses in the management of turf and landscapes. For example, they may be used in combination with wetting agents to relieve localized dry spots. The wetting agent will allow the water to penetrate into the hydrophobic area causing the dry spot, eliminating the hydrophobic effect. Then, the hygroscopic humectant will prevent the area from drying

out again, since it will continually condense water vapor into water droplets.

Using hygroscopic humectants is an excellent way to reduce overall landscape water use. When applied to large turf or landscape areas and watered into the root zone, these products will allow plants to more effectively utilize any water they receive through rainfall and irrigation. When water is applied to the soil, it has one of three fates. First, it can be pulled down by gravity deeper into the soil and eventually added to the ground water. Second, it may evaporate and escape the soil back into the atmosphere above the soil. Finally and most favorably, it can be used by the plant. Hygroscopic humectants effectively minimize the loss of soil water to evaporation by condensing the escaping water vapor back into liquid form for the plant to use. In fact, these products have been documented to reduce overall water use by as much as 50 percent.

When seeding, hygroscopic humectants are a valuable tool in optimizing seed germination and establishment. When applied over the seed and into the seedbed, these products will reduce the drying effects in between irrigation and rainfall events. Therefore, the seed is able to germinate more rapidly, and then establish and develop due to more favorable moisture conditions. This effect is also experienced in hydroseeding and sprigging.

The establishment and maintenance of trees, shrubs and ornaments are an ideal use for hygroscopic humectants. The water capturing capability of these products will allow plants to establish quickly and survive drought conditions more successfully. The use of hygroscopic humectants in potted plants is especially valuable in reducing watering events from every day during hot, dry periods to every other or every two or more days. This application not only saves water but labor as well.

Hygroscopic humectants are a valuable tool for turf and landscape managers. Used alone or in combination with other technologies, these products are valuable in reducing overall water use on all parts of the landscape. At this time, hygroscopic humectant products are available from Ecologel Solutions as Hydretain, from BioPro Technologies as H3O, and from John Deere Landscapes as Moisture Manager.

References

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