Container Gardening, Soil Media and Hydrogels

Whether you have limited garden space, poor soil, or simply want to visually enhance an area, container gardening is always a winning idea. Container gardens provide an instant landscaped look, add color, and the shape, size, and color of the container can be used to compliment outdoor living spaces. Beginning gardeners can use containers as "training wheels" to become more comfortable with gardening in larger areas.

Containers come in a range of shapes and sizes ranging from expensive, decorative materials like terra cotta (unglazed red clay), glazed ceramic pots, and concrete to less expensive whiskey barrels, plastic pots, bushel baskets, and even recycled bulk liquid containers. Porous containers will dry quicker in summer but retain moisture in winter making them more prone to cracking during freezes. Hanging containers and wire baskets lined with sphagnum moss or coconut fiber may better suit your space.

Adequate drainage is critical to container gardening success. Water logged soils have no pore spaces for oxygen necessary for healthy plant roots and unhealthy roots are more susceptible to disease. Drill holes in the bottom of containers without existing drainage holes. Larger containers require more drainage holes. Container inserts are available if you plan to use decorative containers without drainage holes. However, the insert should not be in direct contact with water.

Sterile, soilless potting mixes containing peat, perlite, vermiculite and other materials are excellent for providing adequate aeration and nutrients. Native soils are not recommended because they are usually high in clay and inhibit drainage. Disease organisms can build up in container soils - especially when annual plants are grown. It is a good idea to replace soilless mixes with new, sterile material every year when growing annuals. If a soil-borne disease is suspected, you should also soak the pot in a 10% bleach solution and rinse well before replanting.

A container should accommodate the roots of the plants when fully grown. Larger vegetables such as tomatoes, eggplant, pepper, cucumbers, and beans should be planted in five-gallon containers or larger. Herbs grow well in smaller containers. With flowers, a general rule is the larger the height of the flower, the more root mass is produced thus requiring a larger container. Combinations of annual flowers, bulbs, herbs can really look outstanding.

Containers require frequent watering because the exposed sides result in more evaporation. Plastic containers do not dry out as quickly as ceramic, especially unglazed ceramic pots. Even plastic containers may require daily or twice daily watering as plants grow larger. Do not allow containers to dry completely or fine roots will die.

Given the limited soil volume and frequent drainage, container plants require periodic fertilization. Time release or diluted liquid fertilizers are a convenient method to keep plants looking healthy and producing flowers and fruit. Frequent irrigation and fertilization forces you to visit your containerized plants often. This is a good thing because it forces you to observe their progress, slow down, and enjoy your outdoor living space.

The use of water-holding polymers or gels, mixed with the soil before planting, can increase the amount of water held and extend the time between irrigation. Hydrogels are sometimes referred to as "root watering crystals" or "water retention granules" because they swell like sponges to several times their original size when they come into contact with freely available water. These products have been used successfully by the landscape industry to reduce transplant shock and increase containerized plant growth.

There are two broad classes of polyacrylamide (PAM) hydrogels: soluble (linear) and insoluble (cross-linked). Linear PAM dissolves in water and has been successfully used in reducing irrigation-induced erosion in agricultural fields. Cross-linked PAM does not dissolve, but forms a gel when water is added and is often used in garden, landscape, and nursery situations as a way of retaining moisture. Insoluble PAM products are marketed as “superabsorbent gels” or “hydrating crystals.” Instead of dissolving, these gels absorb water, swelling to many times their original size. As they dry, water is slowly released to the soil. Cross-linked PAM products are what gardeners are sold for container gardening.

How PAM gels will act in any given situation can be hard to predict, as the chemical interactions between the gels, soil components, and dissolved substances are complex and occur simultaneously. Without getting too scientific, specific soils have unique combinations of physical and chemical properties. Some soil factors include electrical charges, water holding capacity, and forces that cause individual molecules to attract or repel each other (called van der Waals forces). These characteristics modify the affinity of the gel for other compounds. PAM gels also contain a complex array of positively charged, negatively charged, and neutral chain segments, all with varying affinities for other molecules.

The stronger the attraction between the gel and surrounding soil minerals, nutrients and/or salts, the greater the ability of the gel to absorb water, create aggregates, and stabilize soil structure. Unfortunately, some conditions can prevent PAM hydrogels from functioning optimally. Fertilizers and other dissolved substances can interfere with hydrogel water-holding capacity. Hot, dry weather conditions can lead to increased degradation and decreased effectiveness of PAM hydrogels. And for every success story, researchers have found situations where hydrogels have failed to function.

The documented impacts of cross-linked PAM hydrogels on plant survival and establishment are variable. Some researchers report enhanced growth of crop and tree species. According to other researchers, however, PAM hydrogels did not improve plant survival compared to control or other treatments, especially if performance was evaluated over time. In several cases, PAM-treated plants performed worse than the untreated controls and exhibited measureable nutrient deficiencies. PAM gels will also break down over time because of naturally occurring soil microbial activity

Aside from these variable results, some gardeners are concerned with the safety of PAM hydrogels. As the name suggests, polyacrylamides consist of many linked acrylamide subunits. Acrylamide is a known neurotoxin in humans and is suspected to be carcinogenic as well. During the manufacture of PAM gels, residual acrylamide is present as a contaminant and strictly regulated in the United States to levels no more than 0.05% or 500 ppm for agricultural use. However, an international study recommended that polyacrylamide gels used in cosmetics contain a residual monomer level of only 0.1 to 0.5 ppm. Therefore, the PAM hydrogels manufactured for agricultural and garden use can contain much greater concentrations of (1,000 to 5,000 times) toxic acrylamide than that found in personal products causing concern among some users.

Additional health issues can be presented by exposure to the more or less intact polyacrylamide gel where toxic effects have been documented. Health risks associated with the breakdown products of PAM hydrogels are entirely unknown, but exposure risk could be great to gardeners and green industry workers that are exposed over time. Given these findings, the use of PAM hydrogels in container gardening may not be worth the potential risk.

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