Your plants get stressed when it gets hot

Are you and your plants suffering from the summer's sizzling heat? Average summer temperatures in the San Rafael area hover around the low 80s but, interspersed in these lazy summer weeks, are many days during which temperatures reach the upper 90s and beyond. When I walked into my garden the day after temperatures climbed to 101°F, I was dismayed to see what appeared to be brown, scorched, half-opened flowers on my hydrangeas! A sad sight indeed! Amazingly, new tissue has developed so it appears the hydrangeas will survive.

Heat stress is often defined as a period in which temperatures are hot enough for a sufficient period of time to cause irreversible damage to plant function or development. Plants can be damaged by either high day or high night temperatures and by either high air or soil temperatures. A plant's temperature usually runs just above the air temperature. Trees and shrubs enjoy optimum growing conditions when the temperature ranges between 60 - 85°F. The magnitude of heat stress increases rapidly as the air temperature rises above 85°F. The thermal death threshold is reached at 115°F, but varies with the duration of the hot temperatures, the absolute highest temperature reached, tissue age, the water content of tissue, and the ability of the plant to make adjustments to temperature changes. Surface soil temperatures reach their highest monthly readings in late August; highest daily temperatures occur in the late afternoon. Plants in black plastic containers in full sunlight can absorb radiation at 9°F per hour until they reach 125°F or more. As a general rule, each 18°F increase in temperature results in a physical doubling of respiration and water loss.

High day temperatures can injure plants directly by causing hot tissue temperatures, or indirectly by creating plant-water deficits that arise due to high transpiration demands. Transpiration is the evaporation of water from the leaf surface; it is also the way that plants cool themselves. A fully grown tree may lose several hundred gallons of water through its leaves on a hot, dry day. About 90% of the water that enters a plant's roots is used for cooling under these warm dry conditions. The amount of water lost by a plant depends on its size, the intensity of the surrounding light, temperature, humidity, and wind speed (all of which influence evaporative demand).

Not surprisingly, evaporative demand exhibits near exponential increases with increases in daytime temperatures. When transpiration is limited by hot temperatures, plant tissue temperatures can rise above the thermal death threshold. Because new plant growth cannot cool itself adequately, heat injury can be the cause of sudden foliar collapse during exceptionally hot weather in the late spring or early summer. Associated with rapid water loss and temperature increases in the leaves is a delay in water absorption by the roots. Leaves can lose water much faster than the roots can absorb water. The difference between

water loss from the plant and water gain from the roots can cause many problems. In leaves, wilting is the first major symptom of excessive water loss and heat loading.

Leaves under heavy heat loading progress to senescence, brown-out and finally are shed. If unchecked, the heat stress syndrome results in progressively decreased photosynthesis, increased respiration, a major slow down in transpiration, and plant starvation through the rapid use of food reserves. Adding wind to the equation, hastens the process. Studies have shown that high temperatures can increase the plant's rate of reproductive development, which shortens the time for photosynthesis to contribute to fruit or seed production. Heat stress problems also make the plant more susceptible to pests and other environmental problems. A number of pathogenic fungi are more effective in attacking trees when the host is under water and heat stress.

Cool annual species (e.g., lettuce, spinach, brassicas, radish) are more sensitive to hot weather than warm-season annuals (e.g., bean, cucurbits, tomato, zucchini). It is amazing how a little water can bring a plant back to life. I can return to my garden after a hot day and find my New Guinea impatiens plants in containers looking like they're on their last legs. Shortly after giving them some water however, they bounce right back and look wonderful.

Not much can be done for trees and other plants once injury has occurred. To help prevent heat injury in the future, mulch around trees with an organic mulch and water trees and shrubs during dry periods. Mulch lowers soil temperature and decreases the loss of moisture due to evaporation. Water should be added to thoroughly moisten the root zone; the amount will depend on the size and species of the plant. Carefully probe the root zone to help determine the moisture content of the soil before watering. Well-established gardens require less supplemental irrigation during summer drought than newly planted areas. Mixing humus into the soil improves the water-holding capacity of sandy soils and water penetration of clay soils. In addition, partial shading to reduce incoming radiation with arbors and trellises and use of low density, organic, surface covers that have evaporative attributes, e.g., ground covers, can help your plants cope with heat stress. By following these measures and planting natives and drought tolerant plants, you will be rewarded with a healthy, productive garden, despite the heat.

By Martha Proctor