

Surround[®]

Crop Protectant

Studies Show Improved Plant Water-Use Efficiency with Surround

Surround[®] Crop Protectant represents a breakthrough opportunity to improve the health and productivity of a wide variety of fruit and vegetable crops. Surround covers plant surfaces with a protective film – a layer of highly engineered calcined kaolin particles – which provides protection from sunburn, heat stress and certain harmful insect activity.

Developed in conjunction with the United States Department of Agriculture USDA, Surround has shown to improve water-use efficiency of treated plants, resulting in improved photosynthesis, plant health and plant performance.

How Does Surround Affect Water-Use Efficiency in Plants?

Three general environmental factors affect the “demand” for water: light, temperature and relative humidity. If a plant can meet the environmental demand for water, there is no stress and the plant is very productive. However, if the plant is unable to meet the environmental demand for water, then varying degrees of stress will develop. The determining factor for whether a Surround-treated crop uses more or less water relates to if, and for how long, the plant shuts down and restricts water loss. With stomata closed, a plant will use less water, but it will also be less productive and, potentially, suffer damage.

When conditions are extreme, the plant’s natural defense mechanism closes stomata to conserve water, and photosynthetic processes are shut down or reduced accordingly. During this period the plant is undergoing significant stress, including cell damage as sunlight continues to deliver energy which the plant’s cells cannot productively absorb. During extreme conditions, entire cells and whole leaves can be killed. Or with lesser damage, the plant expends energy to repair the damage.

A Surround-treated plant will be cooler than an untreated plant because Surround reflects substantial amounts of infrared radiation. If treated and untreated plants remain below the temperature, or environmental demand, at which they will close their stomata, the Surround-treated plant will use less water. This is because plant water loss increases dramatically with plant temperature (and the Surround-treated plant will be cooler all day compared to untreated plants).

However, if the Surround-treated plant is at a temperature below such a shut-down temperature threshold and an untreated plant is OVER the threshold and cannot meet the environmental demand, the untreated plant will use less water for the time period during which its stomata are closed, while those of the Surround-treated plant will be open. This might be for a few minutes or a few hours per day; however during the rest of the day the Surround-treated plant will use less water than the untreated plant. And during the time of plant shut-down, significant plant stress and damage can occur in addition to the plant being non-productive.

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Does A Surround-Treated Crop Use Water More Efficiently?

Yes, Surround enables the plant to withstand more severe ambient temperatures, therefore prolonging the period in which photosynthesis can take place. When photosynthesis is occurring, the plant continues to use water. In addition, the treated plant continues to grow and manufacture carbohydrates, thereby enhancing its potential for maximum yield.

How Do I Calculate The Effect of Surround On My Crop?

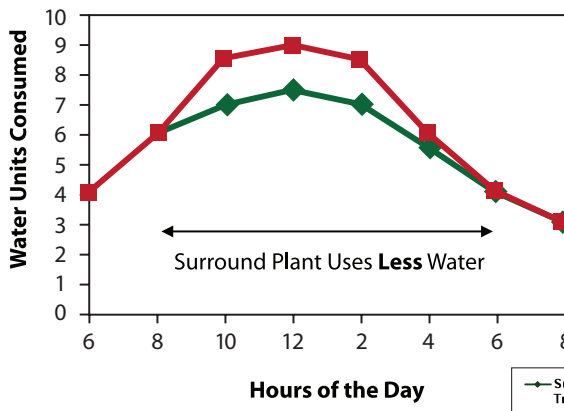
A theoretical example may help explain this phenomenon of how efficiently water is used. Calculating the exact benefit is difficult because conditions vary from hour to hour and day to day.



Less Extreme Conditions and/or a More Heat Tolerant Plant

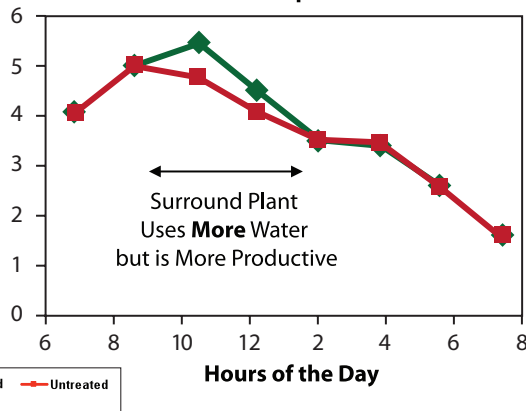
(Stomata closure is not reached by either the Surround-treated or the untreated plant.)

Plants with Minimal Heat and Water Stress



More Extreme Conditions and/or a Less Heat Tolerant Plant

Hotter or Drier than Optimal Conditions



Under these conditions the Surround-treated plant remains cooler all day and uses less water than the hotter, untreated plant. The environmental demand for water in the Surround-treated plant is reduced due to the lower canopy temperature.

Under these conditions both plants get hot enough that their stomata close down because they cannot meet the environmental demand for water. But because the Surround-treated plant remains cooler, it reaches the shut-down temperature later in the day than the untreated plant. In this example the Surround-treated plant will use more water during midday but will be more productive and will suffer less damage.

Important: Always read the label before buying and follow label instructions when using this product.

The use of Surround® in agricultural crop protection applications is covered by US Patents 6,027,740; 6,069,112; 6,110,867 and 6,156,327.

CONDITIONS OF SALE – LIMITED WARRANTY AND LIMITATIONS OF LIABILITY AND REMEDIES

Failure to strictly follow label directions may cause injury to crops, animals, man or the environment. Tessenderlo Kerley, Inc. (TKI) warrants that the product conforms to the chemical description on the label and is reasonably fit for the purpose referred to in the directions for use when properly applied in normal weather conditions. TKI makes no other warranty or representation of any kind, express or implied, concerning the product, including no implied warranty of merchantability or fitness for any particular purpose. The exclusive remedy against TKI for any cause of action relating to the handling or use of the product is a claim for actual out-of-pocket damages, and in no event shall TKI be liable for special, indirect, incidental or consequential damages or expense of any nature, including, but not limited to, loss of profits or income, whether or not based on the negligence of TKI, breach of warranty, strict liability in tort, or any other cause of action. TKI and the seller offer the product, and the buyer and users accept it, subject to the foregoing conditions of sale and limitations of warranty, liability and remedies.

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