CLOVER: Capillary Low-gravity ground cOVER (How's that for an acronym?)

Modified Clover for Dew Collecting via Capillary Gradient in Low/Microgravity, by Quinn Morley

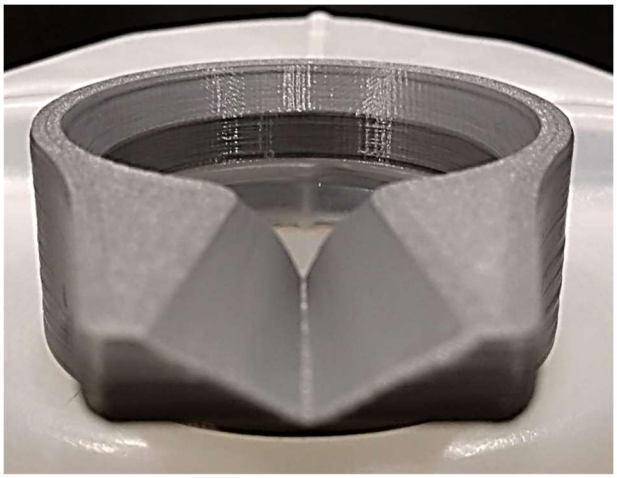
Clover or other water-efficient ground covering plants could be modified by genetic engineering or selective breeding (the "modified groundcover") such that the leaf and stem geometry forms a capillary pathway, or capillary gradient, for the purpose of transporting water collected on the leaves into the soil, raising the soil moisture content for the benefit of other plants (the "crops"). It is noted that the modified groundcover should have a desirable effect on the soil, i.e., nitrogen fixing, etc. in order to reduce the demands on the soil and/or provide for more intensive soil use, in addition to the primary selection criteria for capillary pathway or capillary gradient.

When growing crops on Mars, Earth's moon, in microgravity, or other off-Earth locations, the modified groundcover could be used to augment or eliminate an irrigation system. At chosen intervals the humidity in the growing area could be increased, and temperature changed, with the goal of creating an environment below the dew point for a period of time long enough to introduce sufficient moisture content into the soil via this capillary effect from the modified groundcover. In microgravity (or possibly lunar gravity) this could enable increasing the moisture content of soils on all sides of the habitat simultaneously (including the ceiling).

This method has several potential advantages over traditional irrigation methods in low-gravity environments. Nutrients could be introduced into the air during these dew point intervals and transported through the entire body of soil via diffusion from the base of each modified groundcover plant into adjacent soil, or via distribution by a fungus network linking the root systems of the modified groundcover and crops. In this fashion the moisture and nutrient content of the soil local to the crops could be adjusted by simply controlling the condition of the circulating air in the habitat. In addition to inducing a below-dew-point state at intervals, fogging or misting the habitat from one or several location at intervals may be a more efficient way to provide the modified groundcover with the desired moisture and nutrient content for transport into the soil.

Capillary action in general, and therefor capillary gradients, work far better in lower gravity fields than on Earth. For this reason, the applications of capillary techniques are often overlooked. For example, the author developed a spout that can be added to a jug of Costco milk in order to tame the unruly jug, and provide a drip-free pour. This is a case where despite the gravity field of Earth, a capillary solution can still be found and implemented.

A similar looking gradient would work for the modified ground cover, and could route water from the gradient area (the center of the leaf) to the capillary tube (the stem) in a far more effective manner due to the weaker gravity fields on Mars or the Moon. In place of a capillary tube on the pour spout, a simple v-channel is used to return the drip to the milk container. The existing C-shape on some clover stems is very close to this and it is likely that it could be enhanced to form a highly effective capillary tube.



Above: Capillary gradient feature of the spout. Below, three captures of drip retention and transport.