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Dew as an Adaptation Measure to Meet Agricultural and Reforestation Water Demand in a Changing Climate

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Dew harvesting, believed to be an ancient technique, has recently re-emerged as a viable and sustainable water resource. Nightly yields are relatively low, yet non-negligible, and dew events occur more frequently than rainfall promoting its effectiveness, particularly in arid and semi-arid regions. In this study, we demonstrate how dew can be harvested and subsequently used for small-scale irrigation to meet agricultural and reforestation water demand.

Polyethylene dew harvesting systems were constructed and placed in the field. Dew was harvested as a result of the radiative cooling during the night, thus allowing dew formation under conditions of high humidity. Condensed dew formed upon the planar surface was collected by gravity. Water demand for selected crops and trees within a pilot study area (Lebanon) was estimated using a deficit irrigation model. Simulations of water demand requirements of various plants and surfaces were performed and compared to dew volumes to assess the ability of the system to meet all or in part the plant water demands across seasons.

Data from the polyethylene low-cost dew condensers have shown that within the pilot study, average nightly dew yields were 0.1 L m-2 of condensing surface with a maximum yield of 0.4 L m-2. Dew events occurred generally more frequently than precipitation events, with an estimated 40% of nights producing dew condensate. This translates to 50 mm of equivalent rainfall on average (during dew nights), with a maximum of 200 mm in one night, if one assumes using drip irrigation over a seedling within a 20 cm2 area. Using a simple deficit irrigation model, it was demonstrated that crops such as the tomato plant, which typically has a growing season during the dry summer, can potentially be irrigated solely by dew, thus eliminating the need for traditional irrigation sources. Similarly, young tree seedlings, such as the cedar tree, can depend upon dew as a primary water resource. Moreover, based on similar deficit irrigation strategies, dew was found to be a suitable irrigation option with minimal adverse impact to crop yield or growth rates within our pilot area.