VARIABLE RATE DRIP IRRIGATION SYSTEM

Brief Description of Technology

Current drip irrigation systems have an inherent water application variability. They simultaneously over and under water crops within a management zone, resulting in lower yield, lower product quality and higher costs. For example, standard practice uses 90% adequacy which would mean that 90% of the field is over-watered. The Precision Drip technology optimizes delivery of water and nutrients giving total and verifiable control to irrigators thereby enabling precision irrigation for high value crops.

The patented Precision Drip (PD) variable Rate Drip Irrigation system does not rely on pressure compensation to ensure that actual and desired irrigation amounts match. Rather, in each emitter a special nozzle forms drops of known volume, and electronics associated with the nozzle count the drops as they are applied. Feedback control halts the flow from each nozzle when application targets are reached. This approach has distinct advantages: 1) The PD VRDI system can operate at pressures that are 90% lower than pressure compensated system (direct energy savings); 2) Verifiable control of the applied water allows irrigators to save both water and energy; 3) performance degradation with wear or the onset of fouling is immediately detected, (giving confidence to irrigators that compensation via 'a little extra' water or fertilizer is not required). [1, 2]

<u>Irrigation that is precise in location, timing, and quantities</u>

A user of our system could create bespoke management strategies for every single vine. Each emitter is capable of interfacing with a broad range of sensors and relaying the collected data through our communication network. Multiple protocols are supported. A sensor-emitter pair can operate autonomously, or the aggregation of data collected across the entire field could be used to drive the system collectively either by grower instruction or by algorithm. Managers could determine which inputs are relevant because the PD system can integrate with existing and future sensors.

The PD system saves power, water, and fertilizer. However, these economic savings are situation dependent. For example, in the "white zones" of California water costs can exceed $1000 / ac ft. Whereas the same amount of water in Oregon's Willamette Valley costs $3 / ac. ft.

Brief Description of Commercial Applications

"*Precision viticulture allows us to manage – not just characterize – yield and quality variability – Improve yield of low-capacity vines – Improve fruit quality of high-capacity vines"* [3 slide 39].

Yield improvement of 350% and increased quality of 28% are projected in the literature [3 slide 38] with respect to the transition to precision viticulture. In these sources, precision viticulture is defined as precision pruning, canopy management, and irrigation. Pruning and canopy management solutions are available in the marketplace but precision drip irrigation is not. Precision Drip fills this gap.

Our analysis of the total viticulture market in the US (2017) finds a production of 711.4 million gallons [4] with a 2020 US market value of ($66.8B) [5, 6]. However, the total addressable submarket that seeks full precision viticulture is unknown. Results from our initial customer discovery work are encouraging but the main focus of the NSF I-Corps Teams effort will be to address this and other unknowns.