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Bio-inspired, low-cost, self-regulating valves for drip irrigation in developing countries PAWEL ZIMOCH, ELIOTT TIXIER, ANETTE HOSOI, AMOS WINTER, Massachusetts Institute of Technology — We use nonlinear behavior of thin-walled structures - an approach inspired by biological systems (the human airway, for example) - to address one of the most important problems facing subsistence farmers in developing countries : lack of access to inexpensive, water-efficient irrigation systems. An effective way of delivering water to crops is through a network of drippers, with up to 85% of the water delivered being absorbed by plants. However, of the 140m hectares of cropped land in India, only 61m are irrigated and just 5m through drip irrigation. This is, in part, due to the relatively high cost of drip irrigation. The main cost comes from the requirement to pump the water at relatively high pressure (>1bar), to minimize the effect of uneven terrain and viscous losses in the network, and ensure that each plant receives the same amount of water. We demonstrate that the pressure required to drive the system can be reduced significantly by using thin-walled structures to design drippers with completely passive self-regulation that activates at approximately 0.1bar. We also report on our work towards reducing the overall price of drip irrigation systems by as much as 90%, and making them more affordable for 800 million subsistence farmers worldwide.

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