Energy Recovery and Water Treatment from Fertigation

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Mixing a concentrated fertilizer with irrigation water releases energy. This means that in fertigation processes throughout the world, there is an energy potential that has not yet been harnessed. Recovering this energy can be a step towards improving life cycle efficiency, reducing cost of fertilizer, and reducing cost of food production. Fertilizer gradient energy can be used for water filtration and purification via forward osmosis. The amount of fertilizer a plant consumes each day has the potential to filter all the water it needs from wastewater or other sources. It also can be converted to useful work via several means including pressure retarded osmosis. Until now, there is uncertainty about the limits to water filtration and the potential to produce fertigation solution with suitable concentration for plants. This work analyzes the combined energy recovery and water treatment potential of various crops and agricultural systems with consideration for fertilizer and irrigation requirements and thermodynamic and practical limits. The tradeoff between quantity of water and energy versus rate of water and energy extraction is presented as the primary challenge that faces fertilizer gradient energy conversion.