

# Expanding Farm Partnerships to Trial Human-Urine-Derived Fertilizer on New Crops

Presented by: Arthur Davis & Tatiana Schreiber

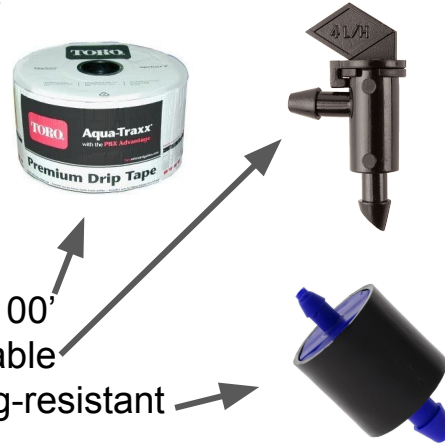


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# Drip Irrigation Trial for Rich Earth Institute SARE 2020 Partnership Project

For this experiment, we tested the reliability of urine fertigation with 3 different types of drip emitters:

- AquaTraxx medium flow drip tape, 60 GPH/100'
- DripWorks Take-Apart 1 GPH emitter, cleanable
- DripWorks Non-Plugging 1 GPH emitter, clog-resistant



For each of these emitter types, we used 3 treatments:

- Water-only control
- Urine/water mix, followed by water rinse
- Water, then urine, then water (not mixed)

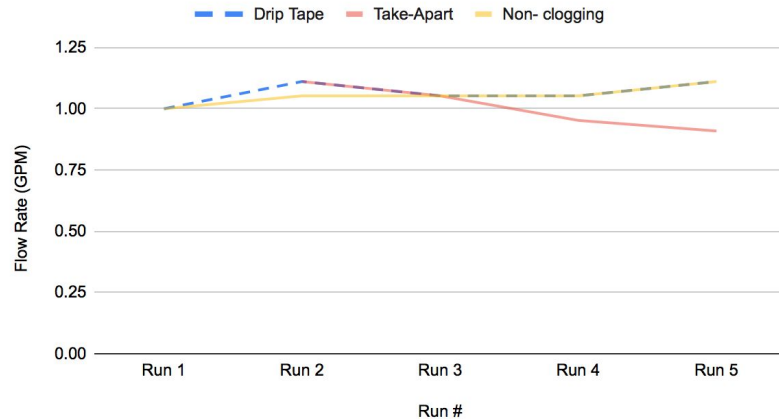
Our goal was to determine the optimum method and materials for using urine in a drip fertigation system without clogging the emitters. We used hard water so as to simulate a "worst-case scenario" where the minerals in hard water could react with the phosphorus in urine to precipitate struvite and plug the emitters. We conducted two trials using different hardnesses of irrigation water: Hard Water (124 ppm) in Trial 1, Very Hard Water (255 ppm) in Trial 2. A 200 mesh prefilter was used inline for all trials.



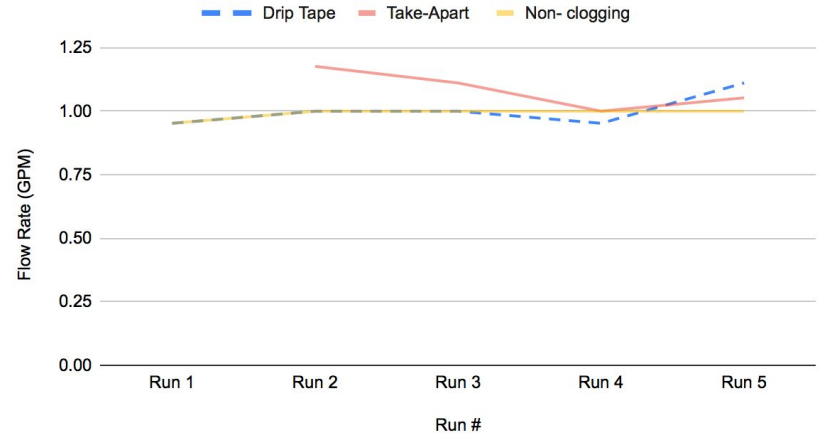
Our experimental set-up

First Trial: We did five consecutive irrigation sessions for the nine combinations of emitter and application method. We measured the amount of time it took to apply 20 gallons of 124 ppm hard water (or water + urine) and used that measurement to calculate flow rate. These graphs show that flow rate did not change significantly for any of the emitter and application method combinations over the course of the five irrigation sessions.

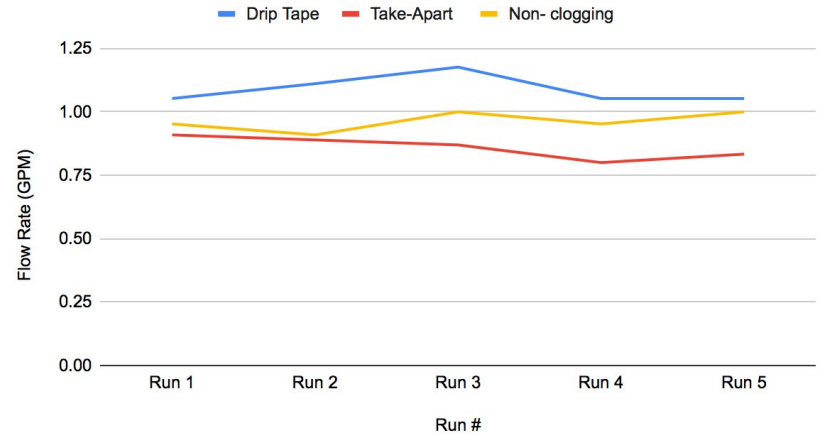
First Trial: Mix



First Trial: Water

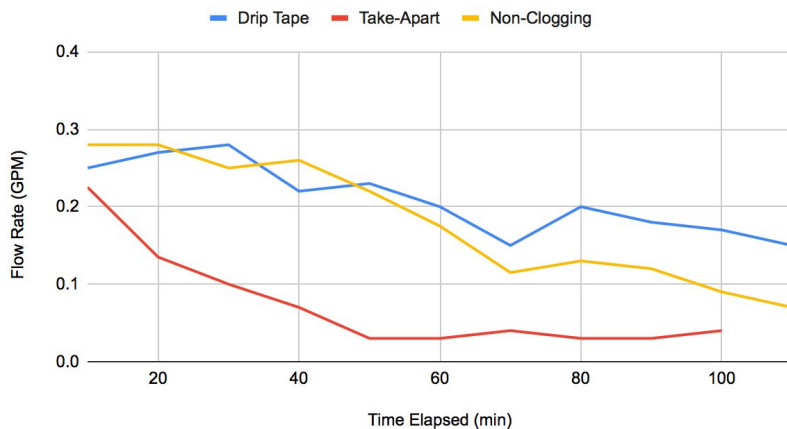


First Trial: Water/Urine/Water

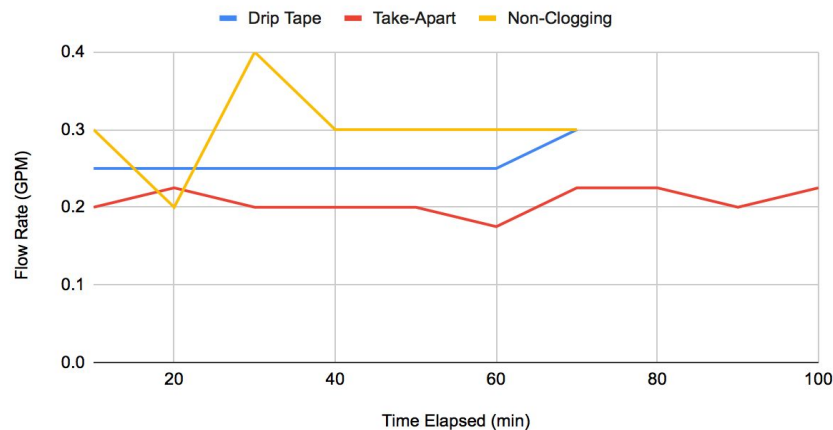


Second Trial: We increased the water hardness to 255 ppm and did a single, longer run for each emitter/application method combination. For the Water-Urine-Water treatment, we did a single, long injection of urine into the line instead of 5 smaller ones. We can see that the Mix treatment resulted in a decreasing flow rate across all emitter types (worst with the Take-Apart emitters), while the Water and Water-Urine-Water treatments showed no decrease in flow rate in any emitter type. (Absolute flow rates are lower than the previous trial because fewer emitters were used in each test configuration.)

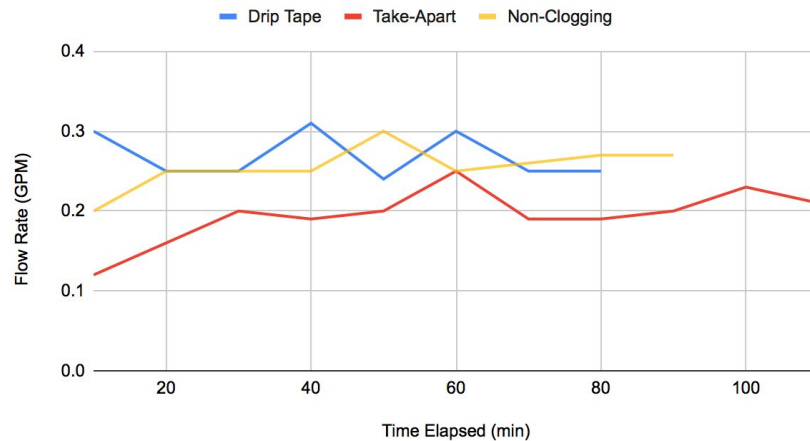
Second Trial: Mix



Second Trial: Water



Second Trial: Water-Urine-Water



# Conclusions

- For irrigation water with a hardness up to 124 ppm, urine can be used for fertigation mixed in with irrigation water or alternating with irrigation water using drip tape or non-clogging (non-plugging) emitters. Though take-apart emitters appear to be viable with water up to 124 ppm, flow may be reduced more quickly than with the other emitter types.
- When fertigating using urine and irrigation water with hardness above 124 ppm, the urine and water should be pumped into the irrigation system in an alternating sequence, to minimize mixing. All three emitter types seem to work well under this usage, but the take-apart emitters appear to be more inherently prone to clogging than the other two types.

# Farmer Collaborations

- Elm Lea Farm at Putney School, Putney, VT: Fertilized hay with Rich Earth Institute's liquid "band" applicator
- Rebop Farm, Brattleboro, VT: Fertilized greenhouse-grown figs using hand-application--prospects for future drip fertigation
- Tapalou Guilds, Guilford, VT: Fertilized cut-flowers and hemp using hand-application
- Hubbard CBD, Westminster, VT: Fertilized CBD hemp using drip tape fertigation
- Pete's Stand, Walpole, NH: Fertilized sweet corn by subsurface side-dressing of urine during cultivation



Side-dressing corn with  
"injection" fertilization method  
during cultivation of sweet corn  
in Westminster, VT





Close-up  
view





CBD hemp seedlings  
fertigated with urine in  
existing drip irrigation  
system in Westminster, VT






A photograph of a high-tunnel greenhouse. The structure is covered with a translucent plastic film supported by a metal frame. Inside, several long rows of fig plants are growing in raised beds. The plants have large, green, lobed leaves. The ground between the rows is covered with dark plastic mulch. In the background, there is a wooden building with a large open doorway. A yellow tag is visible on one of the plants on the right.

Fig grown in a  
high-tunnel in  
Brattleboro, VT.



# Social Research Component

Mid-season interviews with  
our five farm partners






## Farm Partners:

- ❑ Tapalou Guilds: hemp and flowers, hand-applied, low and high dose - Hanna Jenkins and Andy Loughney
- ❑ Elm Lea Farm (Putney School): hayfield, tractor boom, Rich Earth applicator, urine vrs. Manure - Pete Stickney
- ❑ Rebop Farm: unheated greenhouse figs, hand-applied, compost vrs compost + urine - Ashlyn Bristle and Abraham McClurg
- ❑ Hubbard CBD: drip irrigation, low and high dose - Adam Hubbard
- ❑ Pete's Stand: sweet corn, cabbage sprayer and spider-wheel hiller, low and high dose - John Janiszyn







# Why did you want to participate?

□ Hanna (Tapalou): *One of the things for me is to look at things that may be defined or understood from a dominant standpoint as 'waste' and [thinking about] how we can reclaim things that we might label as wasteful and then through simple processes make them useful again...*

□ Pete (Elm Lea Farm/Putney School): *I'm really keen on the process of putting manure or urine or anything like that onto pasture, and certainly, absolutely, if we can keep a resource out of the Connecticut River and out onto the hayfield, all the better! I also want our students to be engaged in it, and any faculty and staff who are interested... I have a little more help and a little more equipment than conventional farmers who are trying to turn a profit, quite frankly, I have a little more time to experiment.*



# How did you decide what you wanted to do?

□ Ashlyn: *Because these [the figs] die back every year in the winter and restart their growth, I felt like what we really needed was a lot of nitrogen to hit the ground running really quickly.*

□ Adam: (Hubbard CBD): *We talked about what the grant was looking for, and what you were looking for as an organization, and what I need, it seemed like a pretty good fit, setting up a comparable, measurable system is intriguing to me... you know, the scientist in us, wanting to know things...*




## How did the collaboration go?

□ Andy (Tapalou): ... *there seemed to be an understanding of what summer looks like for farmers, so it was like two applications, [Arthur] came with a set of jugs, with lines on them, very straightforward, very simple, so we didn't have to think too much about the basics...*

Adam: *Learning is expensive, it takes time and effort, so [we were] trying to work out a system that minimizes my effort but gets results, and it's fun! In order for it to work, it has to be profitable, I want there to be some benefit without just spending time. Arthur and Abe were conscientious of that... I don't have a lot of complaints, actually I really like, I like the possibilities here.*






## Describe the results you are seeing in mid-late August?

- Ashlyn: *What I'm seeing is a lot of success in the sections that are urine-[treated], have the heaviest fruit set, the best growth, we haven't gotten to ripe fruit yet or any kind of weighing, but what so far, what I'm seeing...it's spectacular, fruit all the way down."*
- Pete: *It's very obvious from the dark green here where the urine was applied, dark green in the foreground, lighter green in the background, that's manure only... the entire field was covered with manure...and here's the picture from another angle, a rather striking line here...*





## How did you talk to people about it? What were their reactions?

- Ashlyn: *I'm sure that it will be an issue for some people, but I think that the realities of food growing and where fertility comes from have to be a little bit more accepted if we want to eat and survive; we have to be a little more open as a general public, and as farmers it's really helpful when we're transparent about it.*
- John: *I mean, I'm not shy... I think it's a good idea, and so I would just, you know, I would probably come from a place of saying "Yeah, I think this is a great thing, I'm glad to be a part of this project, trying to figure out how to use this thing we're just sending down the drain, you know, we gotta change, we gotta start re-thinking on how we source our fertilizers, and you know, everything, really."*