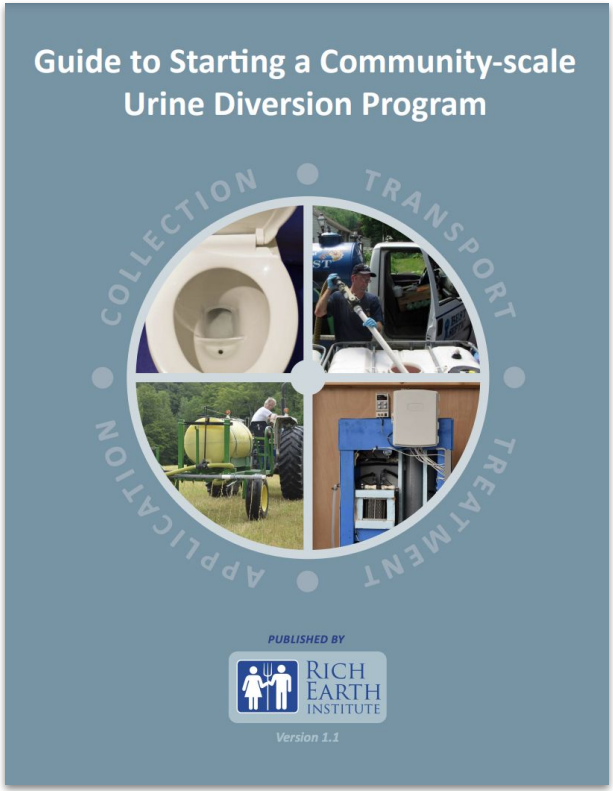
Farmer Guide to Fertilizing with Urine

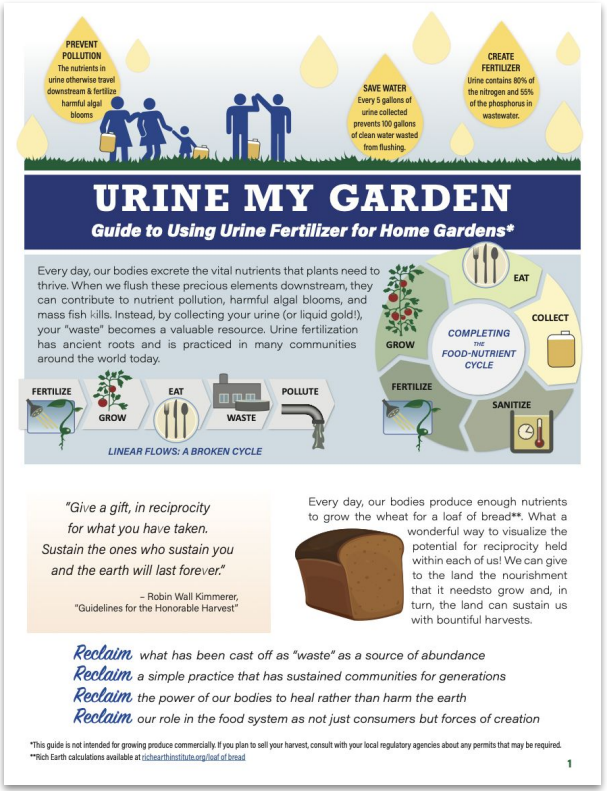
With Findings from the Rich Earth Institute's On-Farm Research

Tatiana Schreiber and Arthur Davis

Facilitating Early Adopters

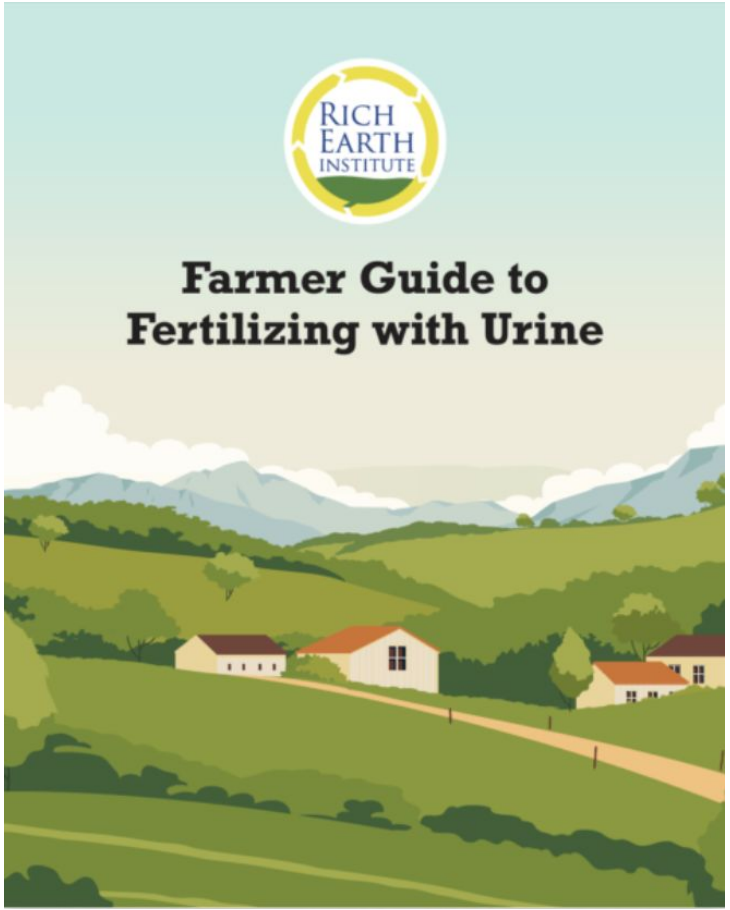


Community Guide



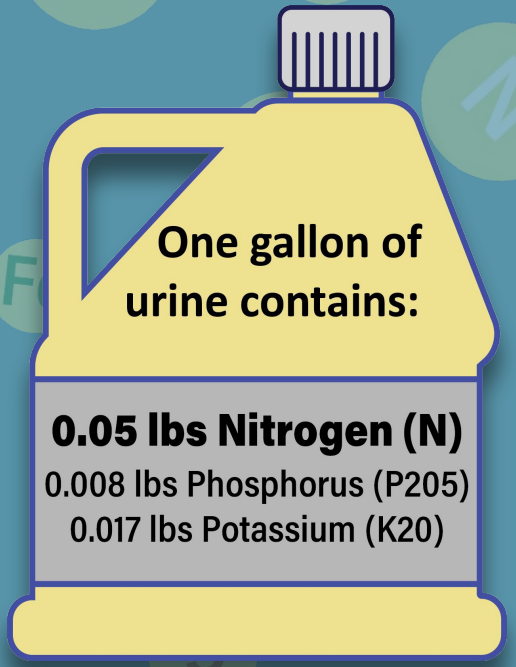
Home Gardener's Guide

Farmer Guide



Contents

Urine as a fertilizer

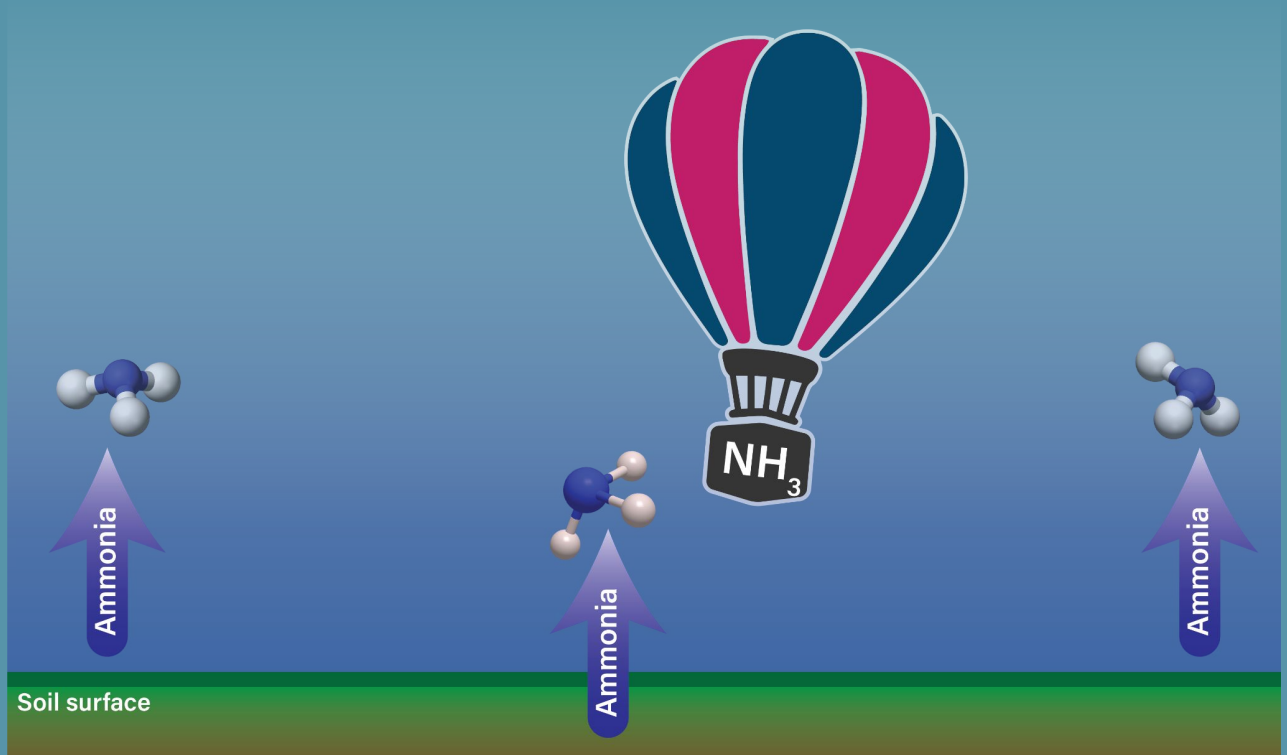


NPK analysis:
0.6 - 0.1 - 0.2

Nutrient	lbs/100 gallons of urine	%
Nitrogen	4.8	0.57
Phosphorus (as P_2O_5)	0.69	0.082
Potassium (as K_2O)	1.6	0.19
Sulfur	0.37	0.044
Calcium	0.019	0.0023
Magnesium	0.0059	0.00071
Boron	0.0016	0.00019
Zinc	0.00025	0.00003
Iron	0.00017	0.00002
Copper	0.00017	0.00002
Sodium	1.2	0.15

Properties of Urine Fertilizer

AMMONIA VOLATILIZATION

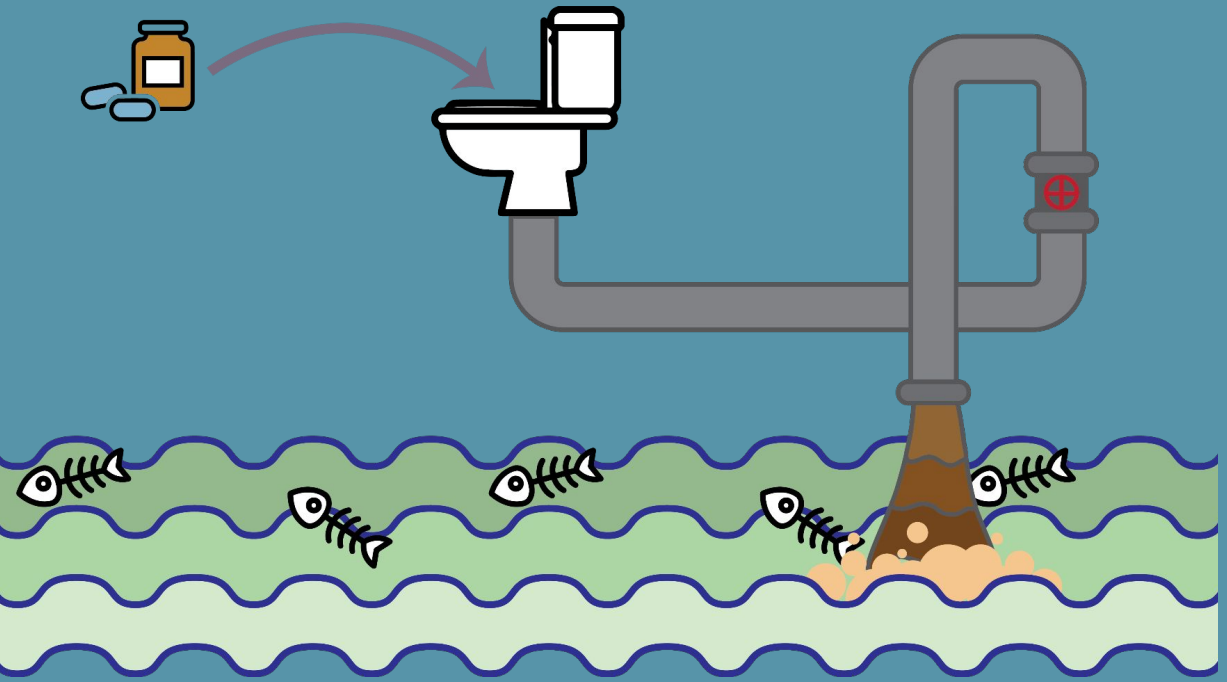


Retaining nitrogen in urine fertilizer:

- During storage, keep urine enclosed from air
- During application, incorporate urine into soil quickly:
  - Incorporate into moist soil: dilute, irrigate, or cover with soil afterwards
  - Don’t spray urine

Safety of Urine Fertilizer

What happens to the pharmaceuticals in our urine?



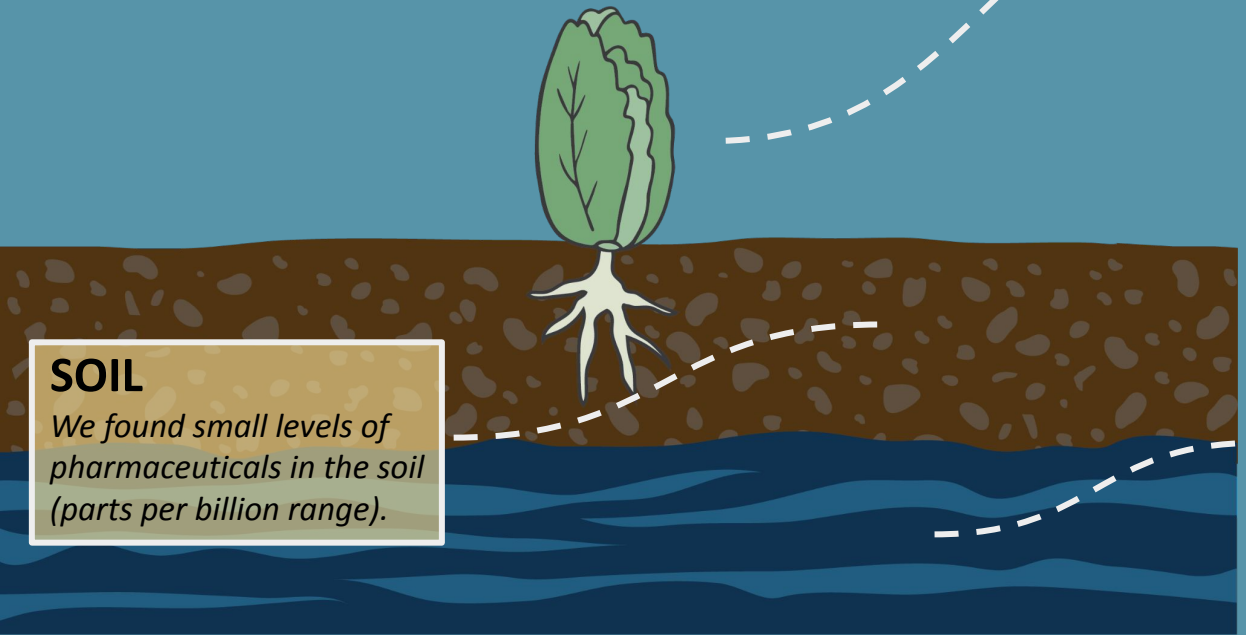
When you take medicine or drink coffee and then flush your pee, what happens to it?

Pharmaceuticals in water bodies can disrupting aquatic life…

Safety of Urine Fertilizer

Rich Earth Institute conducted a 6 year study in collaboration with:

University of Michigan | University at Buffalo | HRSD



CROP

Eat one pound of urine-fertilized lettuce every day for 1,000 years to ingest the caffeine equivalent of one large cup of coffee.

The pharmaceuticals we detected were extremely small – in the nanogram per gram (or parts per billion range.)

SOIL

We found small levels of pharmaceuticals in the soil (parts per billion range).

GROUNDWATER

Pharmaceuticals were detected in the groundwater in even lower levels (parts per trillion range.)

Safety of Urine Fertilizer

PFAS

Regulation

FSMA & Organic Cert.

SARE-funded Agricultural Research at Rich Earth

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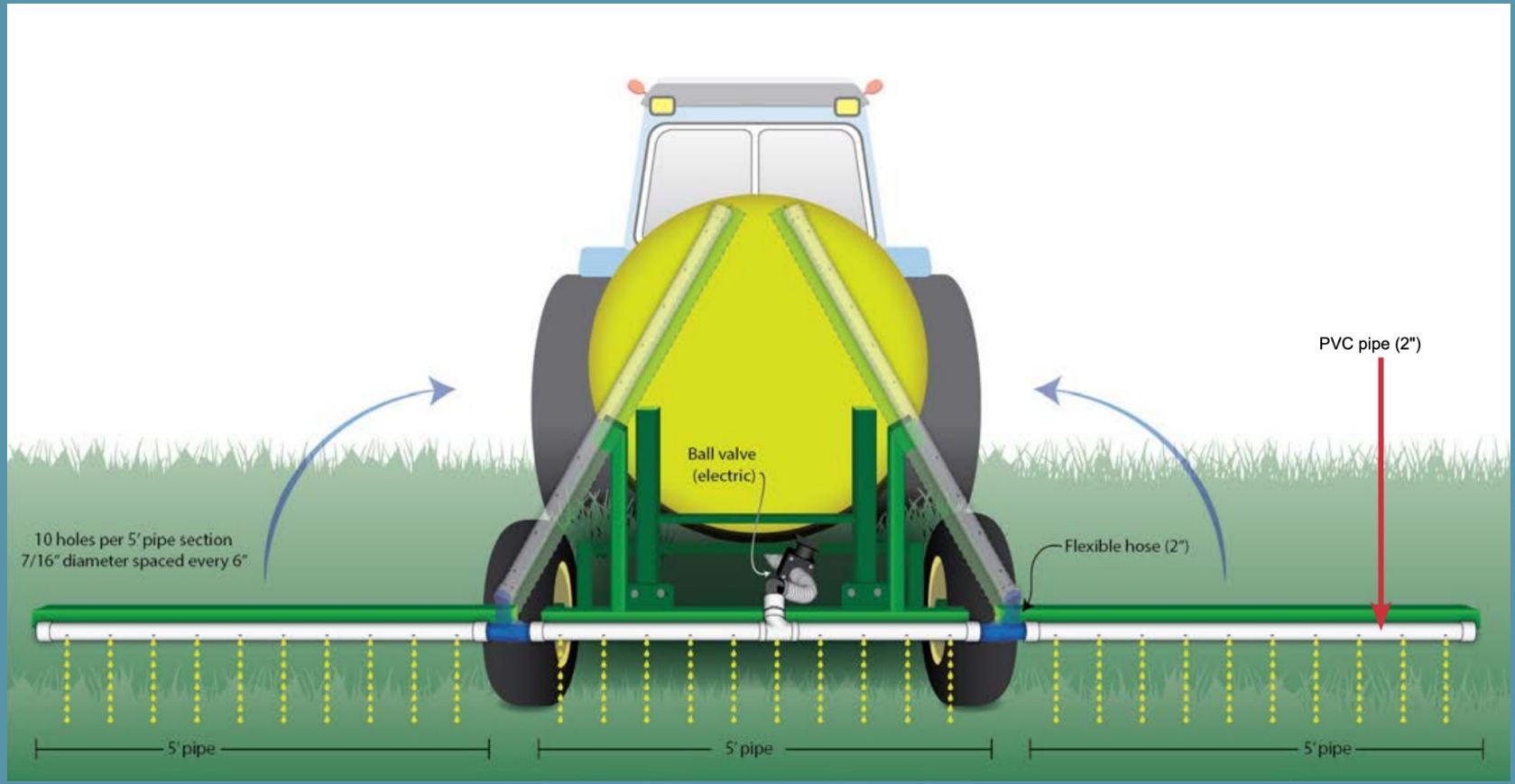
Sustainable Agriculture Research & Education

SARE-funded Agricultural Research at Rich Earth



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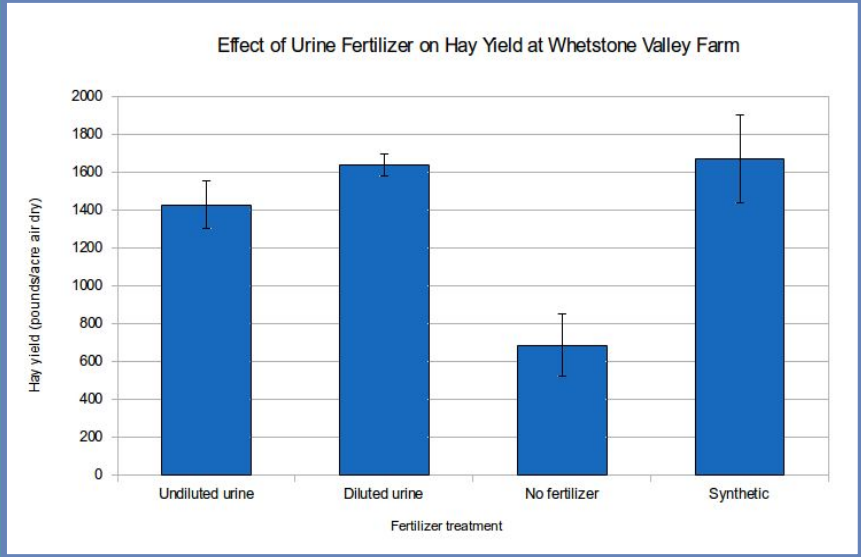
2013 Hay Yield Trials

Hay Yield



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Co-composting with urine + organic matter

Co-composting of urine with leaves can produce a compost that:

- Retains the majority of the nitrogen and other nutrients found in urine
- Is a solid product
- Is aesthetically appealing
- Can be stored inexpensively
- Can be applied using conventional equipment.

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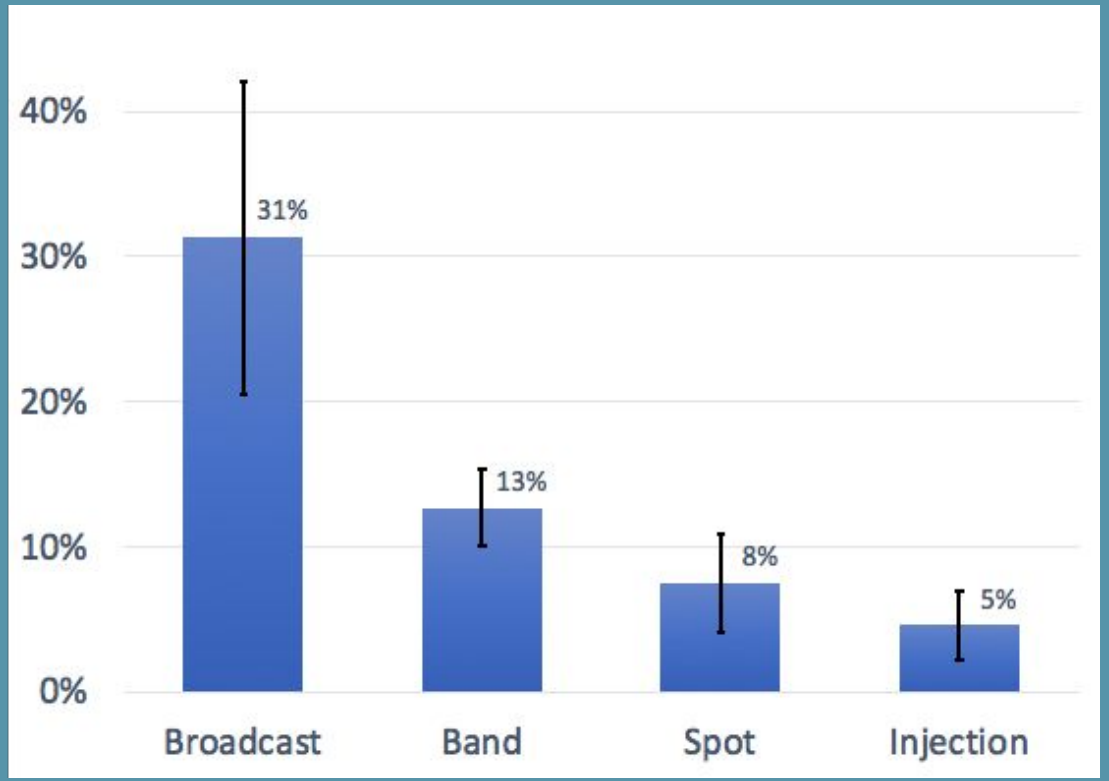
2018 Ammonia Volatilization Trials

Ammonia loss by different application methods



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2021 Ammonia Volatilization Trials

Bio-acidification

1. Add carbon-rich waste materials to liquid manures
2. Fermentation generates organic acids
3. Lower manure pH mitigates ammonia loss

ACID WHEY & SWEET WHEY

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Other Farm Partnerships

Cut flowers

High Tunnel Figs

2021 Fertilization Trials on New Crops

As one farmer partner put it: *…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?"*

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2021 Fertilization Trials on New Crops

💧 Drip Fertigation 💧

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2023 Sweet Corn Trials

Pete’s Stand - John Janiszyn - application with sweet corn

2023 Perennial Nursery Crop Trials

Yellowbud Farm - Chestnut Seedling Fertilization at a wholesale tree nursery

Jesse Marksohn and Eric Cornell

Eric: My experience [in talking to customers] has been generally overwhelmingly positive and interested. There are certainly [some] people that are maybe just don't have the understanding or they're removed from it or there's just like a… baseline cultural distancing from waste and they would react the similarly to maybe using a composting toilet or something. But my experience has been people are very intrigued and excited about about the concept.

2023 Perennial Nursery Crop Trials

Yellowbud Farm - Hickory Seedling Fertilization in Air-Pruned Beds

Jesse Marksohn takes hickory seedling measurements

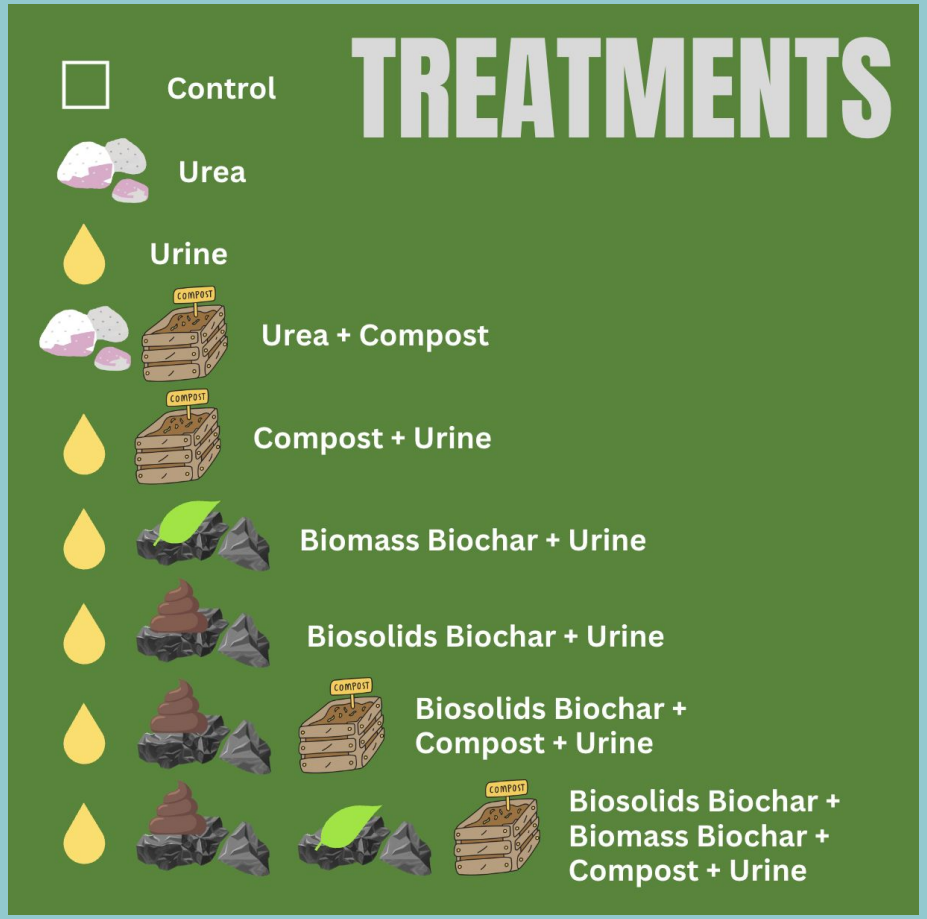
Urine was applied to seedlings at three rates:

1. **High** - .13L per ft sq
2. **Low** - .07L per ft sq
3. **Control** - no urine

Roughly 50% of the high treatment group seedlings were sellable, compared to only a handful from low and control groups

Current Research: SARE Novel Approaches

Soil Health Effects of Biochar (from biosolids + biomass)



1. Research has shown that pyrolyzing biosolids to produce biochar has the potential to reduce many organic contaminants (including PFAS) and immobilizes heavy metals
2. Filtering urine or similar human waste streams through biochar can further immobilize contaminants, such as the residual pharmaceuticals in urine
3. The nutrients in urine can be absorbed in biochar for use on farms as a value-added product
4. This research project assesses the soil health implications of these ammendments, including impacts on microbial communities

Get in touch!

Feedback Surveys:

1. Farm Guide Feedback — **tinyurl.com/FarmGuideSurvey**
2. Home Garden Community Science — **tinyurl.com/UrineMyGarden**
3. Community Peecycling Interest — **tinyurl.com/PeecycleNearMe**