

# Farmer Guide to Fertilizing with

# Urine

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

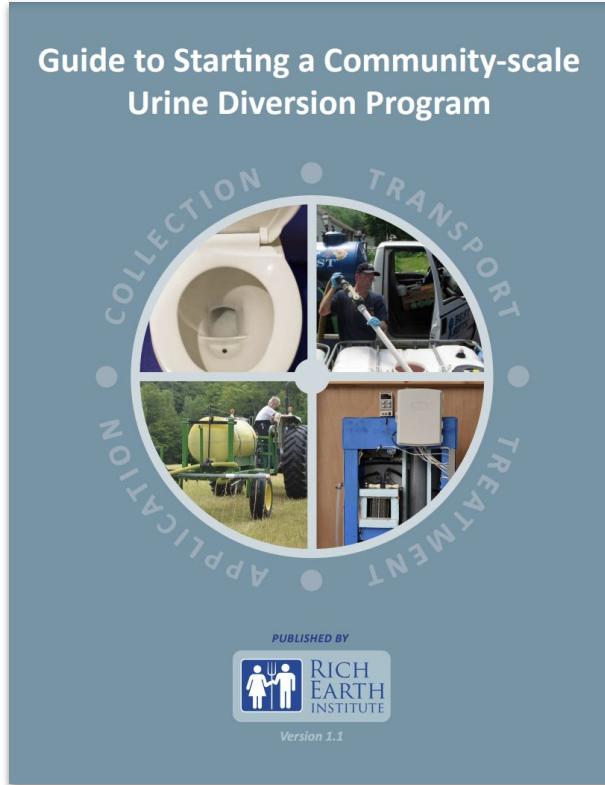
Tatiana Schreiber and Arthur Davis

RICH  
EARTH  
INSTITUTE



NORTHEAST  
**SARE**  
Sustainable Agriculture  
Research & Education

# Facilitating Early Adopters



Community Guide

**URINE MY GARDEN**  
Guide to Using Urine Fertilizer for Home Gardens\*

PREVENT POLLUTION  
The nutrients in urine otherwise travel downstream & fertilize harmful algal blooms

SAVE WATER  
Every 5 gallons of urine collected prevents 100 gallons of clean water wasted from flushing.

CREATE FERTILIZER  
Urine contains 80% of the nitrogen and 55% of the phosphorus in wastewater.

Every day, our bodies excrete the vital nutrients that plants need to thrive. When we flush these precious elements downstream, they can contribute to nutrient pollution, harmful algal blooms, and mass fish kills. Instead, by collecting your urine (or liquid gold!), your "waste" becomes a valuable resource. Urine fertilization has ancient roots and is practiced in many communities around the world today.

COMPLETING THE FOOD-NUTRIENT CYCLE

LINEAR FLOWS: A BROKEN CYCLE

*"Give a gift, in reciprocity for what you have taken. Sustain the ones who sustain you and the earth will last forever."*

— Robin Wall Kimmerer, "Guidelines for the Honorable Harvest"

Every day, our bodies produce enough nutrients to grow the wheat for a loaf of bread\*\*. What a wonderful way to visualize the potential for reciprocity held within each of us! We can give to the land the nourishment that it needs to grow and, in turn, the land can sustain us with bountiful harvests.

**Reclaim** what has been cast off as "waste" as a source of abundance  
**Reclaim** a simple practice that has sustained communities for generations  
**Reclaim** the power of our bodies to heal rather than harm the earth  
**Reclaim** our role in the food system as not just consumers but forces of creation

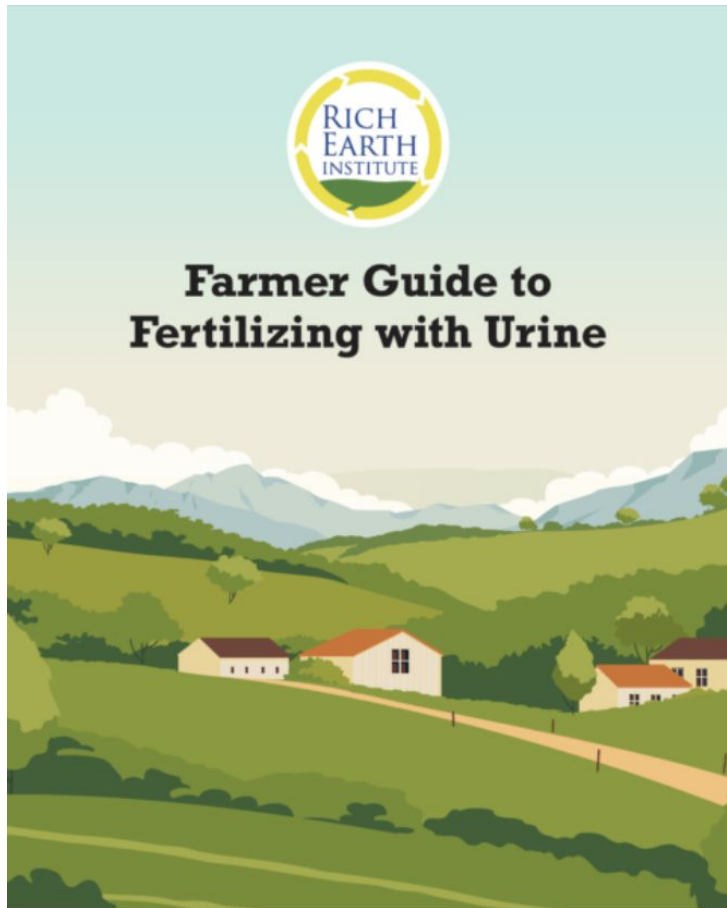
\*This guide is not intended for growing produce commercially. If you plan to sell your harvest, consult with your local regulatory agencies about any permits that may be required.  
\*\*Rich Earth calculations available at [richearthinstitute.org/loaf-of-bread](http://richearthinstitute.org/loaf-of-bread)

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The infographic features a central circular diagram with icons for 'EAT', 'COLLECT', 'SANITIZE', 'FERTILIZE', 'GROW', and 'WASTE'. It also includes a loaf of bread illustration and a quote from Robin Wall Kimmerer.

Home Gardener's Guide

# Farmer Guide



## Contents

### **Regulation**

- Food Safety Modernization Act
- Organic Certification

### **Safety**

- Sanitization
- Heavy metals
- Pharmaceuticals
- Antibiotics
- PFAS

### **Characteristics of urine fertilizer**

- Nutrient content
- Ammonia volatilization
- Salt accumulation
- Effect on soil pH

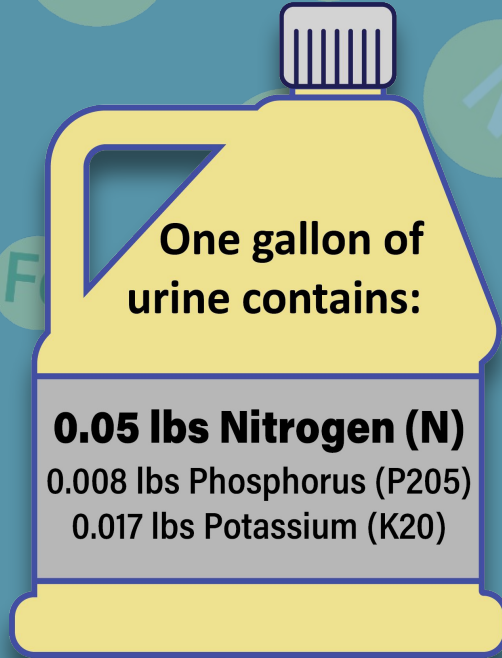
### **Application Methods**

- Calculating application rates
- Application Timing
- Dilution
- Application equipment
- Combining with Other Amendments

### **Experiences with Specific Crops**

### **Talking with Consumers & Buyers**

# Urine as a fertilizer



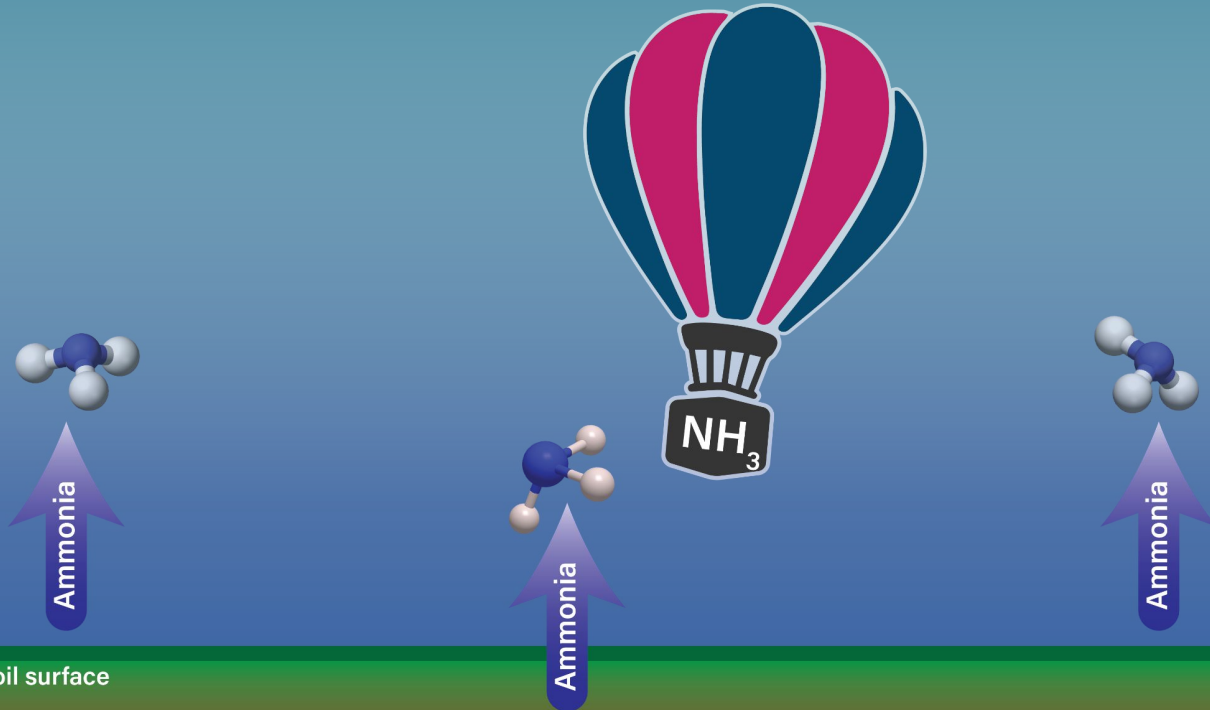
**NPK analysis:**

**0.6 - 0.1 - 0.2**

Nutrient	lbs/100 gallons of urine	%
Nitrogen	4.8	0.57
Phosphorus (as P <sub>2</sub> O <sub>5</sub> )	0.69	0.082
Potassium (as K <sub>2</sub> O)	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

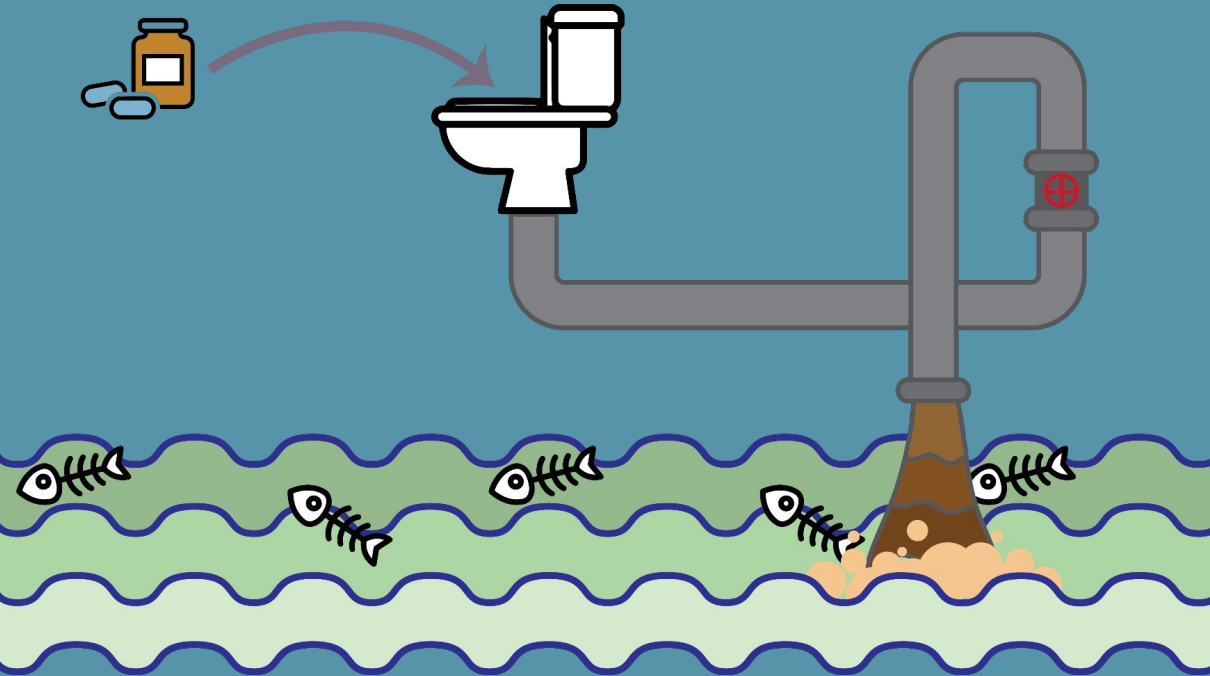


### Retaining nitrogen in urine fertilizer:

- 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 be disrupting aquatic life...

# Safety of Urine Fertilizer

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



## 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



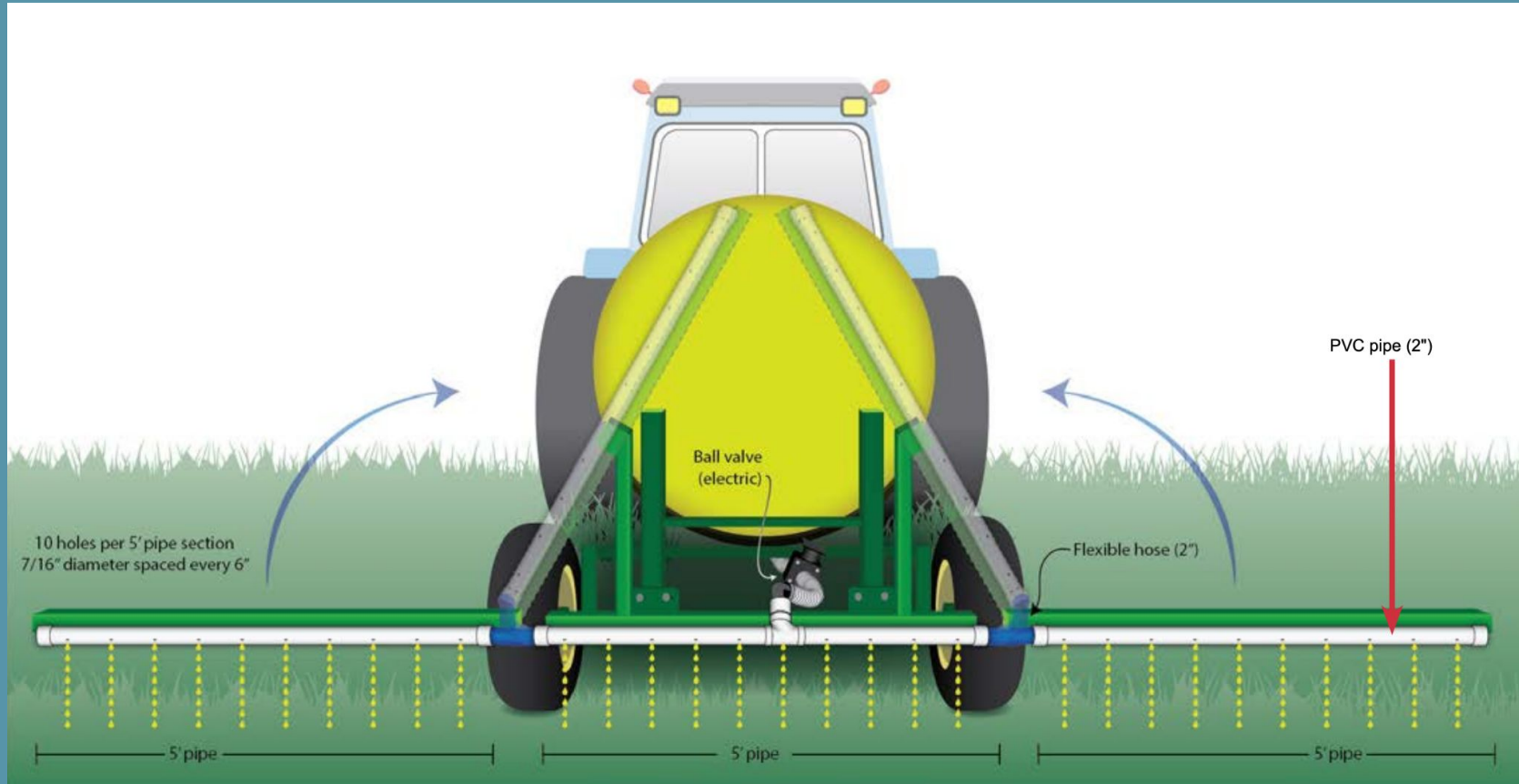
# Regulation

FSMA & Organic Cert.

# SARE-funded Agricultural Research at Rich Earth



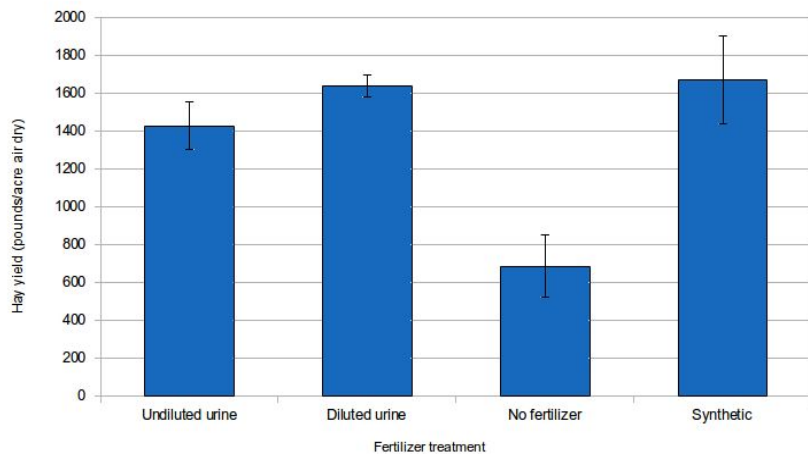
# SARE-funded Agricultural Research at Rich Earth



# 2013 Hay Yield Trials

## Hay Yield

Effect of Urine Fertilizer on Hay Yield at Whetstone Valley Farm



# Co-composting with urine + organic matter

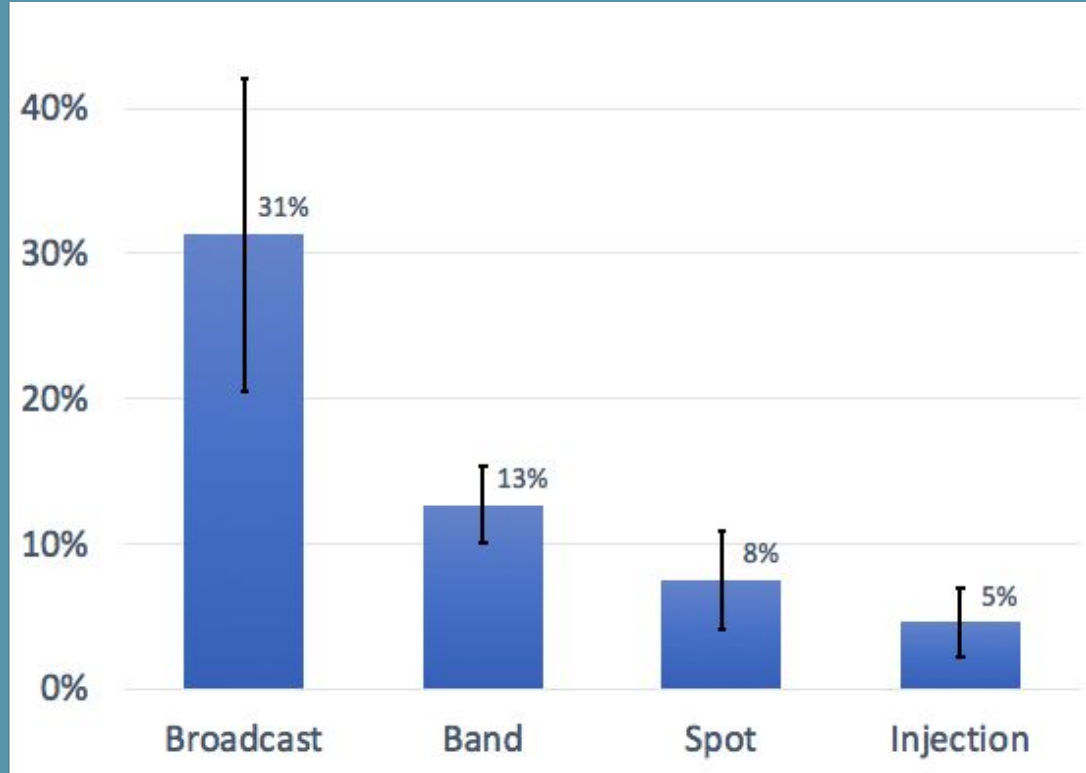
Co-composting of urine with leaves can produce a compost that:

- 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.

# 2018 Ammonia Volatilization Trials

## Ammonia loss by different application methods

% of original ammonia lost



# 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**

## 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?"**

# 2021 Fertilization Trials on New Crops



**Drip Fertigation**

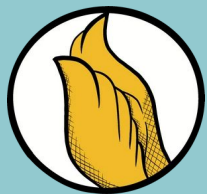


# 2023 Sweet Corn Trials

**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:

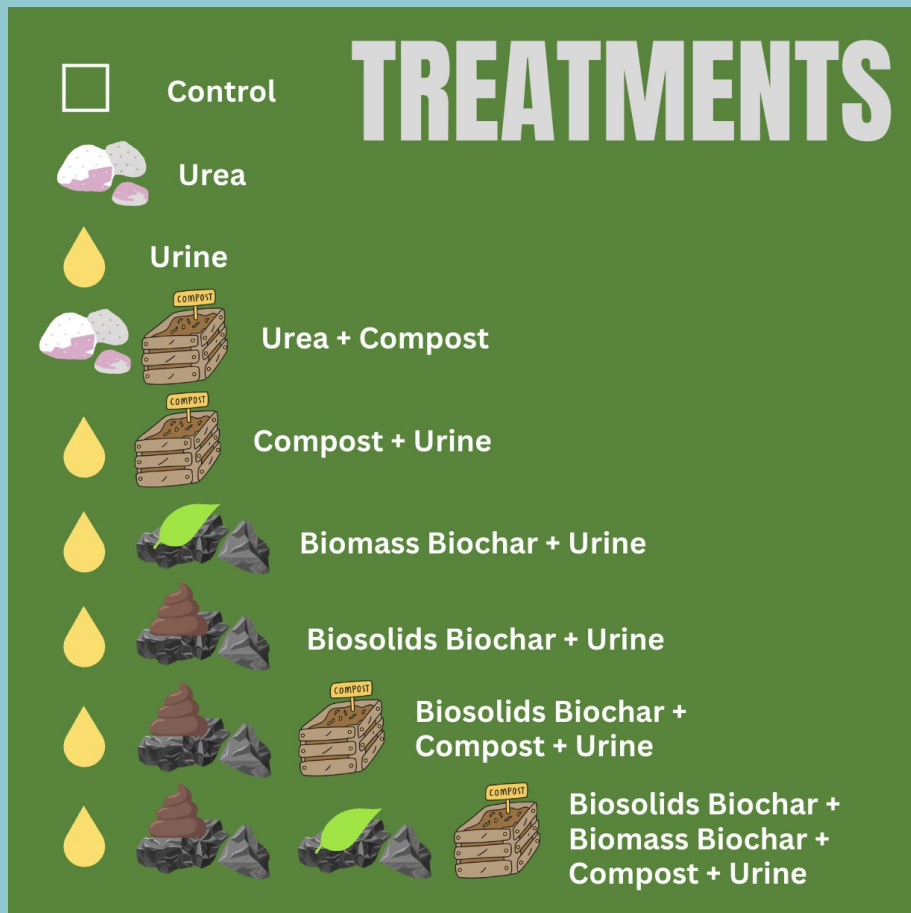
1. **High** - .13L per ft sq
2. **Low** - .07L per ft sq
3. **Control** - no urine

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 amendments, including impacts on microbial communities

# Get in touch!

## Feedback Surveys:

1. Farm Guide Feedback

[tinyurl.com/FarmGuideSurvey](https://tinyurl.com/FarmGuideSurvey)

2. Home Garden Community Science

[tinyurl.com/UrineMyGarden](https://tinyurl.com/UrineMyGarden)

3. Community Peecycling Interest

[tinyurl.com/PeecycleNearMe](https://tinyurl.com/PeecycleNearMe)