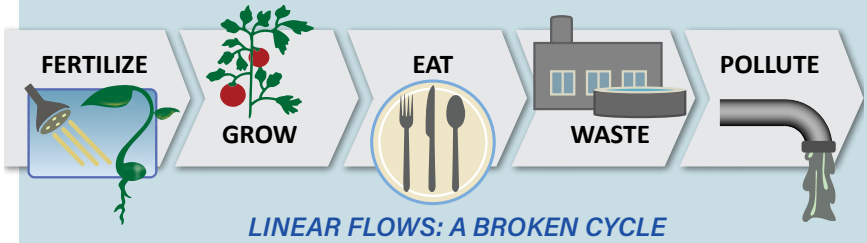
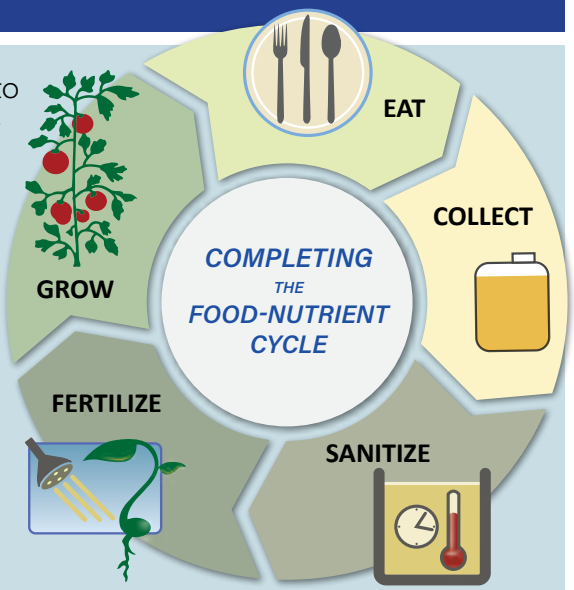
URINE MY GARDEN

*Guide to Using Urine Fertilizer for Home Gardens**

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.



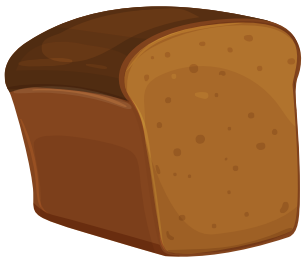
LINEAR FLOWS: A BROKEN CYCLE



"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 needsto 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

Properties of Urine Fertilizer

NUTRIENT CONTENT

Urine is rich in nutrients, including the macronutrients nitrogen, phosphorus and potassium, as well as secondary and micronutrients. One gallon of urine contains 0.05 lbs nitrogen, 0.008 lbs phosphorus, and 0.017 lbs potassium. Agricultural field trials, including Rich Earth's own research on hay, have demonstrated that urine fertilizer provides crop yields comparable to synthetic fertilizers of the same nitrogen content.

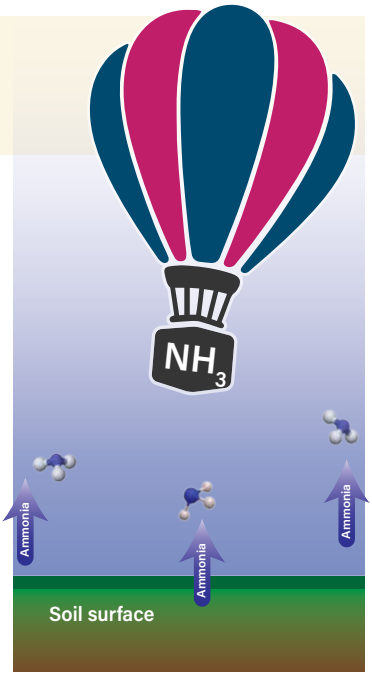
Element	lbs/gal	%
Nitrogen	0.047859	0.5746%
Potassium	0.013266	0.1593%
Sodium	0.012263	0.1473%
Phosphorus	0.003033	0.0365%
Sulfur	0.0037	0.0445%
Calcium	0.000195	0.0024%
Magnesium	0.00006	0.0008%
Boron	0.000016	0.0002%
Zinc	0.000003	0.0001%
Iron	0.000002	0.0001%
Copper	0.000002	0.0001%

While urine is used as a fertilizer, poop is rich in organic matter and can also be used as a soil amendment. Different state rules may apply to composting "humanure."

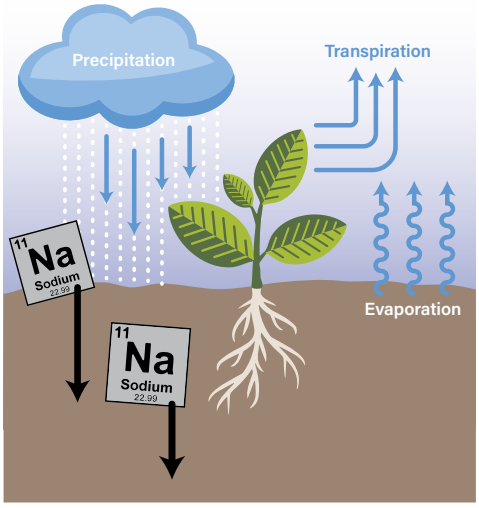
AMMONIA VOLATILIZATION

Although nitrogen is quite stable in the atmosphere, the form of nitrogen in urine (called urea) is highly volatile. The urea in urine can be quickly converted to ammonia gas when exposed to air.

To prevent ammonia volatilization from occurring, it is important to prevent the exposure of urine to air. This can be done through storing urine in air-tight containers and incorporating urine into moist soil during fertilization.



SALT ACCUMULATION



Urine contains significant levels of salt, but this usually isn't a problem for outdoor gardeners in humid climates, including the Northeast. In these climates, precipitation isgenerally greater than soil evaporation, and the rainwater/snowmelt will wash the salts down into the soil, away from plant roots.

However, if you are growing in an enclosed environment, like a greenhouse, or if you live in an arid or semi-arid region, salt build-up is a potential concern. We do not yet have recommendations for using urine in these dry environments. If you want to try it, be sure to monitor your soil for salt accumulation. If you notice the salt beginning to accumulate, you can flush the soil with water.

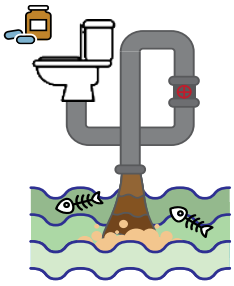
Safety

Pathogens:

Urine is typically very low in pathogens (though not truly sterile), The primary pathogen risk comes from urine collected via urine-diverting toilets, where fecal contamination is possible. Guidelines published by the World Health Organization in 2006 specify that urine from a single household can safely be used on home gardens without any pre-treatment. (If you live with someone who is sick, you are far more likely to be infected by sharing a household/bathroom with them tha through the urine fertilization pathogen pathway).

Heavy metals:

Heavy metals are low to non-detectable in urine; much lower than some other common fertilizers, such as commercial phosphate fertilizers, manure, and biosolids.



Pharmaceuticals:

Urine can contain pharmaceutical residues. When we flush urine into wastewater systems, these chemical compounds are generally not removed and accumulate in downstream water bodies with disruptive effects on the species who live there. By diverting urine from the wastewater stream, we can protect these sensitive aquatic ecosystems and water supplies.

When urine is applied to the soil as a fertilizer, our own research and a number of other studies have not found pharmaceuticals to accumulate in crop tissues at significant levels. While there are some pharmaceutical compounds detectable in crop tissue, the levels are extremely small–in the nanogram per gram (or parts per billion) range. Perhaps unsurprisingly, caffeine is by far the most abundant drug found in human urine. But the molecule is present in such tiny amounts in urine-fertilized lettuce that you would have to eat a pound every day for 1,000 years in order to ingest the equivalent of one large cup of coffee. The levels of other pharmaceutical compounds are even lower than this.

Research findings suggest that soil microbes may be helping to break down the pharmaceuticals. Rich Earth is now conducting research to better understand how urine fertilization affects soil microbial communities.

HOW TO FERTILIZE WITH URINE

1 Collect

Collect your urine fertilizer in a watertight, airtight container - this will prevent smelling and leaking, as well as any nitrogen loss during short-term storage.

DIY COLLECTION

pStyle
Stand-to-pee Personal Urination Device
thepstyle.com

RICH EARTH PEECYCLING KIT

Odor-blocking funnel attachment with 2.5 or 5 gallon container, available on Etsy:
richearthinstitute.etsy.com

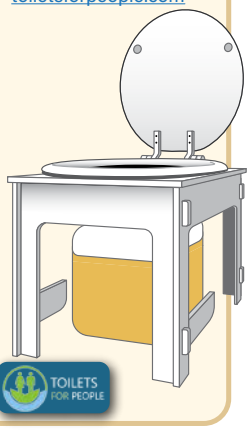
Privacy Sleeve

Nun's Cap
Collection insert for toilet bowl

Spout
For easy transfer

PEE TOILET

toiletsforpeople.com



PREVENTING ODORS

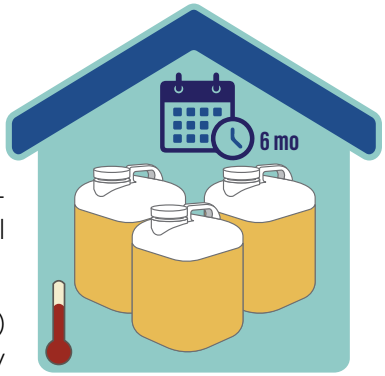
Minimize odors by adding an acid to your collection container before any urine is added. Adding an acid to fresh urine helps reduce odors by stabilizing the nitrogen and preventing its loss as smelly ammonia. We recommend adding 1-2 cups of white vinegar or 1 tablespoon of citric acid per 5-gallons of urine fertilizer.

Adding vinegar or citric acid lowers the pH of the urine, which will affect the storage sanitization process described below. If you need to sanitize your urine using the storage method and would like to use vinegar, then the storage time should start when the urine's pH rises to around 9.

2 Sanitize

Urine from healthy people is generally pathogen free. For home gardeners, **urine fertilizer does not need to be sanitized**. Many people use urine in their home gardens without any treatment. The World Health Organization supports this practice if the urine comes from the same household that will be eating the produce, and if the following guidelines are followed:

1. *Wash hands after handling urine, or wear gloves*
2. *Follow best practices for collection and application*
3. **Wait at least one month (30 days)** *after fertilization to harvest crops that you'll eat raw (such as leafy greens)*

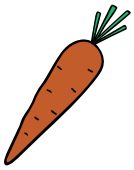


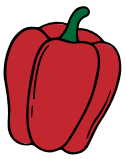
However, **sanitization is necessary** for growing food for public consumption. Contexts such as farms, community gardens, or schools should consult with your local or state regulatory agencies about any permits that may be required..

To sanitize your urine at home, simply store it in an airtight container at 68°F (20°C) or higher for six months. This will raise the pH in the urine high enough to kill any potential pathogens.

The Rich Earth Institute sanitizes our community-collected urine via pasteurization, heating the urine to 176°F (80°C) degrees for 1.5 minutes (US EPA method). This urine pasteurizer is available for larger-scale contexts via our spin-off company, Brightwater Tools.

3 Fertilize





WHO?

Any plant with high nitrogen needs is a prime recipient for urine fertilizer–such as corn, tomatoes, and leafy greens. Many other crops–such as peppers, broccoli, cut flowers, shrubs, fruit and nut trees, and conifers–can also benefit from the range of nutrients in urine. To fertilize trees, apply the urine in a circle that is the same diameter as the tree's canopy (to estimate where the roots of the tree are growing below ground). Nitrogen-fixing plants such as legumes don't need to be fertilized with urine

WHEN?

Most crops should be fertilized with urine during their more active growth stage. Generally, this means when the plant is older than a seedling but before it begins flowering or fruiting. When you plant the seedlings, you can provide them a small amount of dilute urine. After that, apply the urine in several small applications spread out over the growing period, rather than one large application. This provides the plants with nutrients as they need them, and gives them time to take up the nutrients before the excess runs off as pollution.

Wheat Growth Stages & N Uptake Curve

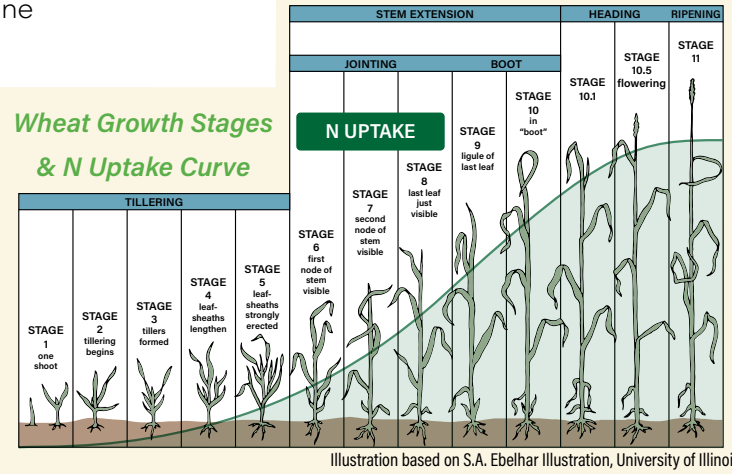


Illustration based on S.A. Ebelhar Illustration, University of Illinois

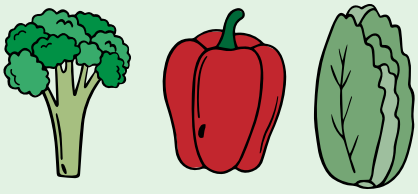
Due to the high nitrogen content of urine, we recommend applying the urine when the plant has its greatest nitrogen needs.

HOW MUCH?

To decide how much urine to apply in your garden, consider:

1. **Nutrient content of urine –** *One gallon of urine contains 0.05 lbs N, 0.008 lbs P, and 0.017 lbs K.*
2. **Nutrient needs of your plants –** *For crop-specific recommendations, check out Cornell University's Nutrient Guidelines for Vegetables.*
3. **Nutrient status of the soil –** *State extension offices can provide soil tests and make recommendations.*

For a 10' x 10' garden, *apply 3.5 - 5.5 gallons of urine over the full growing cycle*



Most vegetables require between 75 and 120 pounds of nitrogen per acre over the life of the crop. (Beans require as little as 40, while others including corn, beets, peppers, and potatoes could require 150 or more.)

At the scale of a 10' x 10' (100 square feet) section of garden, applying 3.5 gallons of urine equates to 75 lbs N/acre, and 5.5 gallons equates to 120 lbs N/acre. This is therefore the range that would supply all the nitrogen needs to most crops over their full growing cycle. If you are also applying compost or have substantial amounts of organic matter in your soil, these sources will supply some of the crop nitrogen needs, and the urine application rate should be reduced.

Overapplying any fertilizer (including urine) can be harmful to human and environmental health. Please don't apply more urine than these guidelines recommend.

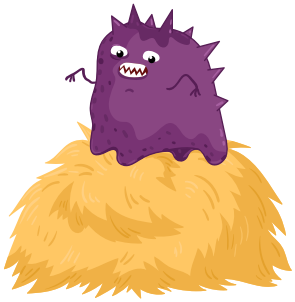
Observation

You can also develop a sense for when your plants need fertilizer through observation, trial and error. Look for signs of nitrogen deficiency such as stunted growth and yellow or pale green leaves, and apply urine accordingly.

Reci-pees

Urine + compost

Adding urine can be an effective way to increase the nitrogen in a compost pile. If you have a high carbon content compost heap (mostly straw, dead leaves, sawdust, or other dry, dead plant material), then it will retain the nitrogen in urine fertilizer - and the urine can actually help accelerate the composting process. However, if you have a very green compost pile already (mostly kitchen scraps or green plant material), then most of the nitrogen in urine will be lost in the composting process.



Urine + biochar

The nutrients in urine can be used to activate biochar.

Urine + wood ash

To increase the amount of potassium added to your soil. Don't mix urine with wood ash (it will make the ammonia more volatile) but rather add both amendments separately to your garden bed as needed

Urine + straw bale

Enriching a straw bale with urine fertilizer can accelerate the decomposition process and feed soil microbes.

Urine + wood chips

To biodegrade woody material & slow down the release of nitrogen

METHODS:

- Wear gloves or wash hands after application
- Apply urine directly to the ground (do not spray)
- Incorporate urine into soil:
  - Apply urine in a hole or furrow at least 4" from the base of each plant and cover with soil
    - OR -
  - Irrigate after application or apply during rain
    - OR -
  - Dilute urine before application

DILUTION

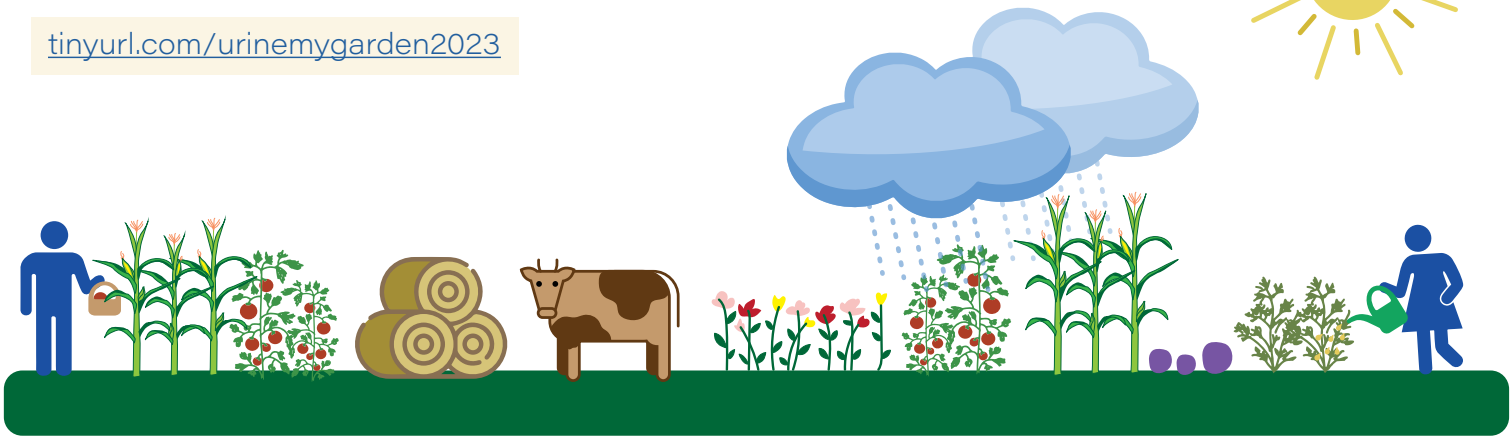
Many gardeners dilute their urine with water before applying. While this is not always a necessary step, it helps the urine soak into the soil, which is especially important in dry soil. Dilution can also help reduce the odor of urine fertilization during application.

Dilution urine:water with ratios in the range of 1:3 - 1:5 is most common according to our community science survey, though ratios can vary from 1:1 to 1:30 depending your intended use.

Community Science

This community science survey will contribute to a growing body of knowledge about where, how, and why people fertilize with urine in their home gardens around the world. While we know urine is used by many, we have little detailed information about specific practices. Your experiences will help us grow our understanding of how urine works for different crops, in varying conditions and will inform our educational efforts. Please take a few minutes (10-20) to complete this survey and share your experiences with the art, science, and practice of fertilizing with urine.

tinyurl.com/urinemygarden2023



BONUS USES

Aside from the benefits of fertilizing with urine, many home gardeners have reported additional uses for urine in the garden. (Rich Earth has not tested these potential benefits ourselves).

Deterring Pests:

Several gardeners report that fertilizing with urine can help reduce insect damage. One gardener said urine fertilization "helps the eggplants to outgrow the flea beetles." Some people also recommend pouring urine around the perimeter of the garden to discourage animals from entering or pouring about a gallon of urine down woodchuck holes, and repeating over several days.

Herbicide:

As anyone knows who's witnessed dog pee turn patches of lawn yellow, urine can also kill plants. This is case of "too much of a good thing." Urine can act as an herbicide to undesired plants through nitrogen burning. One gardener reported that repeated applications of urine to Japanese knotweed (in conjunction with covering the knotweed with tarps) eventually achieved near eradication of the population on their property.

Contact Us

@peecyclers

info@richearthinstitute.org

www.RichEarthInstitute.org

PEE THE CHANGE

Help us spread the word about the power of pee! The infrastructural changes we need for a paradigm shift from linear, wasteful systems to abundant nutrient cycles (such as new toilets, treatment systems, policies, and regulations) take time, energy, and money. But anyone who pees can help to grow the peecycling movement. Whether you take our survey, talk with your friends and neighbors, or document your garden on social media (#UrineMyGarden) we hope you feel empowered to pee the change we need!

NOTES