

DRAFT – Farmer interview guide for SARE 2022 Novel Approaches

Intro Material: [Will include informed consent document]

Thank you for participating in this project concerning the use of novel amendments in agriculture. Your responses will be kept confidential (that is, your names will not be associated with your responses), without your consent. First I want to provide a little background information about the amendments we will be discussing.

As you may know, human urine is naturally rich in the same key nutrients that synthetic fertilizers use to stimulate crop growth. Urine is a high nitrogen fertilizer with moderate levels of phosphorus and potassium, as well as secondary and micronutrients. One thousand gallons of pasteurized urine contains the equivalent of 109 pounds of urea, 13 pounds of triple superphosphate, and 29 pounds of muriate of potash (KCl). The N-P-K ratio is approximately 11:1:2.5. Farmers participating in research projects in Brattleboro over the past several years have had good results applying sanitized urine to hayfields without dilution, achieving yields comparable to synthetic fertilizers. Trials with hemp, sweet corn, figs and cut flowers have also yielded positive results.

In the past, we have conducted research on the fate of pharmaceuticals in urine fertilizer. We found that pharmaceuticals are sometimes taken up by crops, but in extremely small amounts - in the nanogram per gram range. This is similar to levels found in crops fertilized with animal manures or irrigated with treated wastewater plant effluent. Our understanding is that the scientific literature indicates these quantities do not represent a significant risk to human health.

Producing biochar [a form of charcoal produced at very high temperatures] from biosolids [solid product of wastewater treatment] offers an opportunity to convert a waste into a value-added product. It can increase soil organic matter in soils, help mitigate climate change, and improve crop production, while reducing the need for additional external inputs. The benefits of biochar are known to be enhanced further when biochar has been charged, inoculated, or blended with nutrient rich materials before use. Urine could serve that role. Using both the solid and liquid human waste products could be a way to reduce the need for external synthetic fertilizers and use both forms of waste simultaneously. The high-temperature conversion of biosolids to biochar has been shown to reduce many organic contaminants, including PFAS, by over 90% and immobilize heavy metals.

The goal of the site visits and interviews we are conducting for this project is to better understand farmer perspectives concerning the use of human urine and biosolids-derived biochar as potential soil amendments. To do that, we will be talking to farmers at 20 sites in New England and New York, including farms of different sizes, crops and management types to document your current nutrient management practices; your thoughts, concerns and recommendations about these novel amendments; and the types of indicators of soil health that are important to you. I have a number of questions here, but I am most interested in having a conversation with you about this, so if you have other things you want to discuss that I'm not asking, feel free to jump in!

Background Questions:

1. I'd like to begin by learning about your farm. Can you please tell me a little bit about your farming operation?
 - a. How long have you been farming? Farming here? What is the history of past ownership/management here?
 - b. How many acres do you have? How many do you have in production (crops, pasture, woodlot, sugarbush)?
 - c. What livestock do you have? (how many head of each?)
 - d. What crops and/or forage do you grow?

2. Tell me more about how you would describe your operation.
 - a. Would you consider yourself a conventional farmer? Organic? Transitioning? Or something else?
 - b. Can you say a little more about your overall farming goals or objectives?

3. We are interested in learning whether or not farmers are already familiar with the idea of [human] urine diversion or urine-recycling. Is this something that you have already heard about?
 - a. [If yes]: What have you heard about this?
 - b. [If yes]: How did you learn this information?

4. We'll talk more about this a bit later, but for the moment, as you think about the idea of diverting urine from the waste management system and using it as a fertilizer, what are your initial reactions?

- a. Are there any benefits to it you can think of?
 - b. What disadvantages or concerns might there be?
5. Similarly, have you heard about the use of biochar made from biosolids as a soil amendment?
 - a. [If yes]: What have you heard about this?
 - b. [If yes]: How did you learn about this information?
6. As you think about the idea of using biochar from biosolids, what are your initial reactions?
 - a. Are there any benefits to it you can think of?
 - b. What disadvantages or concerns might there be?

Current Nutrient Management and Soil Health Practices:

7. Please tell me about your current nutrient management practices. What types of fertilizers and/or amendments do you currently use on your farm?
 - a. Vegetable crops
 - b. Forage crops
 - c. Tree crops
 - d. Pasture
 - e. Other? Non-edible crops – flowers?
8. How do you determine your fertility and soil health needs? (Ex: soil tests? If so, how often, and what lab do you use?)
9. What are the most important indicators of soil health in your view? (Ex: plant health and yield; fertility; SOM; texture/tilth; microbial activity; other)
Prompt: Tell me more about why that/those are important to you?
10. What would you say are the main factors that influence your decision to use these fertilizers and amendments? (Cost? Source? Effects on soil? Organic certification? Other?)
11. Tell me about the main benefits you've experienced with these fertilizers/amendments?

12. Tell me about any problems you've experienced in using these fertilizers/amendments?

13. When do you apply x fertilizer?

14. Do you use cover crops or green manures?

a) Which ones?

b) How many acres per year would you say you cultivate with cover crops?

c) Can you say a little more about the costs/benefits of using cover crops?

15. Are you currently enrolled in a nutrient management plan?

Potential Use of Novel Amendments (UDFs and Biosolids Biochar)

16. Do you see any potential positive aspects of using fertilizers and amendments derived from human urine and/or biosolids biochar?

17. What questions or concerns would you have about using urine-based fertilizers for crops or forage?

18. What questions or concerns would you have about using biosolids biochar? Would these differ from your thoughts about using a biomass-derived biochar?

19. For which crops would you be most likely to consider using:

a) urine or a urine-based fertilizer on? Why?

b) biosolids-derived biochar?

c) biomass-derived biochar?

20. For which crops would you be least likely to consider using:

a) urine or a urine-derived fertilizer on? Why?

b) biosolids-derived biochar?

c) biomass-derived biochar?

21. What information would be helpful for you to consider using urine-derived fertilizer? (Ex: information about costs, nutrient composition, data on yield, human health impact, soil health effects, effects on plant nutrient composition, effects on livestock eating the forage)

22. What information would be helpful for you to consider using biosolids biochar? (Ex: information about costs, nutrient composition, data on yield, human health impact, soil health impact, effects on plant nutrient composition, effects on livestock eating the forage)

23. Is there other data or research results you would want to see?

24. What support would you need regarding the use of these amendments?

Prompts: (technical info, educational materials, appropriate application equipment)

Decision-making about using UDFs and biosolids biochar

25. Would you consider using urine or a urine-derived fertilizer if the costs were equivalent to a comparable fertilizer you currently use? If it costs more? If it cost less?

26. Would you consider using biosolids biochar if costs were equivalent to a comparable amendment you currently use? If it costs more? If it costs less?

27. Does your overall farming philosophy or strategy affect your thinking about this? If so, how?

28. How would you think about urine and/or biosolids biochar compared to:

- a) synthetic fertilizers
- b) organic or natural amendments and composts
- c) biomass biochar
- c) biosolids (not charred)
- d) digestates
- e) other?

29. When thinking about risks or safety associated with use of a fertilizer or amendment, what forms of communication would be most helpful to you?

Prompts: Would it be useful for you to have comparisons to levels of microcontaminants present in other fertilizers and amendments?

29. Overall, what would it take for you to consider adopting one or both of these amendments (or a combined product)?

30. [For certified organic farmers] Do you think either of these novel amendments should be allowed under the USDA organic program?

[If yes]: Why? Do you have suggestions or recommendations for strategies with regard to obtaining organic certification for UDFs and biosolids biochar?

[If no]: Why not? What would it take for you to support these novel amendments being allowed under the USDA organic program?

31. Where do you get most of your information and advice about soil and nutrient management?

- a) What do you think they [the source of information] would think about the use of urine or urine-derived fertilizers?
- b) What do you think they would think about the use of biosolids biochar?
- c) What do you think they [the source of information] would need to know to better be able to advise farmers on this practice?
- d) Are you part of any farming organization? What information do you think it would be helpful for them to have about this practice?

32. What do you think your customers would think about the use of urine-based fertilizers? Of biochar biosolids?

a. [If negative for either] What do you think would be the best way to address these concerns?

33. In order to make these practices more widespread, what issues do you think would need to be addressed?

34. All of this information is optional, but for our research statistics, it would be helpful to know your:

- a) age,
- b) gender identity,
- c) racial and/or ethnic identity
- d) educational level, and
- e) education/specialized training