Dear Mr. Medina:

I write you in regards to manuscript # UA-2020-07-0007-OA entitled "Tillage and Cover Crop Mix Effects on Urban Soil Performance" which you submitted to Urban Agriculture & Regional Food Systems.

In view of the criticisms of the reviewer(s) found at the bottom of this letter, your manuscript has been denied publication in Urban Agriculture & Regional Food Systems.

Thank you for considering Urban Agriculture & Regional Food Systems for the publication of your research. I hope the outcome of this specific submission will not discourage you from the submission of future manuscripts.

Sincerely,

Dr. Sarah Lovell

Editor, Urban Agriculture & Regional Food Systems

slovell@missouri.edu

Reviewer(s)' Comments to Author:

Reviewer: 1

Comments to the Author

See attached file.

Reviewer: 2

Comments to the Author

(There are no comments.)

Reviewer: 3

Comments to the Author

The paper starts out very promising but many weaknesses emerge as it progresses. First, your statistical analyses do not support many of the assertions you have made. Second, where is your infiltration by cover crop data/analysis? In your discussion you talk about the radishes improving compaction and infiltration, despite your data not supporting it, but is it not possible that the other cover crop mixes might also open up the soil? Third, you need to describe your site more fully so that you and your reader can try to infer more about effects of the site's history and underlying character especially in regards to compaction and infiltration. Please see the comments below for more issues/guidance.

All Figures - Please indicate whether error bars are standard error or a number of standard deviations

Table 1 - Why no Nitrogen?

Fig. 1(C) - Fix spacing between plots

P15L202 - Fix "(F2, 66 = 47.91, p << 0.0001)"

P15L203 - "50% or 7.6 cm or 3” (to ~20.3 cm or 8” depth)" is awkward; also fix "compared to the both other tillage"

P15L210-11 - "...compaction tended to increase by..." This is not clear when presented as a length/depth. Are you saying that "...your depth to the compacted layer decreased by..." the depths stated? Also, you say this finding is consistent "Across all treatments" yet, except in the perennial cover crops, rototilled plots seem to behave the opposite of the tractor-tilled and no-tilled treatments in this regard.

P16L216 - "...in a temperate, urban agriculture site with clay soil."

P16L224 - "...drained all simulated rain water in close to 30 s, or 40 mL/s..."

Infiltration (methods and results) - It is not clear from your methods or results whether you tested infiltration by tillage only or tillage x cover crop??? If not the latter, why not? In your introduction you state that cover crops reduce soil erosion and water run off and that you expected the compaction cover crop mix to have the best infiltration rate, but this is not reported???

P17L236-7 - Would "...weed diversity..." be a better description

Fig. 4 - remove double quotes from "comp" or add them to pere and wdsp.

P20L264-5 - The assertion is not supported by your presented data. The tractor-tilled radishes were not statistically different from the no-till radishes AND had the longest measured radish.

Fig. 5 - Yield measured only in kg is not very meaningful. What is the area over which the yield was measured? Also, where are the error bars for root length of roto-tilled plots. Even with two measurements, you should have error bars. Also, "...in a temperate, urban agriculture site with clay soil."

P21 1st Paragraph - This paragraph either jumps around topics or is entirely incoherent. Plant weight was not significantly different by tillage treatment, according to L263-4, yet on lines 278-9 and 280-1 you state there was significance. The clause starting on line 281, "...while simultaneously measuring..." does not seem to relate to the preceding clause in a way that makes sense to me.

P21L283-4 - "...in the cover crop mix plots named for that targeted function..." could simply be said as "...in the weed suppression cover crop treatment..."

P22L298-9 - "...the natural tendency for clay soils to increase in compaction over time...": All of your tillage treatments were likely in the same clay soils and thus would have been subject to the same tendency. As such, this tendency does not necessarily support your finding of differences between the no-till and tilled. Rather, the fact that disturbed soils will tend to settle more than undisturbed soils would be more likely, rather than a [soil-]texture specific trait.

P22L305 - Did you measure the time it took to till versus using the broadfork? It is entirely possible that tilling could take less time than manually opening soil with a broadfork.

P22L310 - You do not present statistical analysis of changes in compaction from early to late season, which I infer you are speaking of here. Figure 2 does not clearly show that the reduction in compaction was significant. Either present the analysis that supports this assertion or remove this paragraph. If the statistical analysis supports your assertion, it is likely that tractor tillage would produce the same conditions you describe to explain your finding. Yet, you do not assert that the effect was present for tractor-tilled plots. It is possible that rototilling alone was less efficient at breaking up soil peds and in those clay soils, the more pulverized soils in the tractor tilled plots settled more densely than the rototilled plots???

Infiltration (discussion) - The prior use of the specific ground you are using is not clear. Was it previously under a school building? Was it the ground surrounding the former building? If it was under the building, the ground may have been artificially compacted to stabilize the buildings foundation. Was it fill that was brought in after the building was razed and then compacted within the footprint? More history of that ground would be useful to determine why the no-tilled plots had poor infiltration; since, a primary reported benefit of no-till is exceptional infiltration. If this was the first year of managing this ground, it is likely that an initial tillage event, followed by continuous cropping/cover would provide a much better no-till system, at least in comparing the results to other no-till studies. Like the compaction comments above. The more thoroughly clay soils are pulverized via tillage (i.e. your tractor tillage treatment), the more densely they settle out; and, in some cases they can even become hydrophobic and prevent infiltration altogether. In regards to your compost theory. In order to control for tillage depth, it would have been appropriate to apply compost between plowing and roto-tilling. This would have limited the compost depth to a similar depth as your roto-tilled plots. It is not clear from your methods if you applied compost as such or spread it prior to the entire tractor-tillage regimen.

P25L363 - "...potential allergen load for nearby residents..."???

P25L365-6 - reword this sentence, awkward.

P25L374-5 - If your infiltration tests were done with radishes still growing, then no improvement would be expected, since the radishes would be in the way. Tillage radishes open pore spaces as they decompose or are pulled up for harvest or forage.

P25L382-3 - Your no-till plots did not exhibit decreased compaction, so your data does not support this assertion???

Associate Editor's Comments to Author:

Associate Editor

Comments to the Author:

We received three reviews for this paper and all reviewers had serious concerns about the research methods, statistics, and conclusions drawn from the limited data. Unfortunately, this paper is not acceptable for publication in Urban Agriculture and Regional Food Systems. However, the reviewers provided many thoughtful suggestions and I hope you will find them useful as you pursue publication elsewhere.

Review: Tillage and Cover Crop Mix Effects on Urban Soil Performance

The authors of this study examined how tillage of varying intensities and different cover crop mixes influenced the soil ecosystem of an urban lot. As more of the human population lives in urban areas, communities are turning degraded land in cities into food producing spaces. Yet empirical evidence regarding the best strategies and techniques to restore urban soils is lacking, since methods used in rural areas are not always the most economical or effective in the circumstances of the urban environment. The authors established a study area subdivided into 36 subplots. The subplots were divided into three tillage intensity groups (tractor, rototiller, and no-till) and planted with four cover crop conditions (compaction, weed suppression, perennial and null). To understand changes in soil quality in response to tillage intensity and cover crop mixture, the authors measured soil compaction and water infiltration, as well as weed density, percent cover, and species richness.

**Overall** -- The study does advance the science of urban agriculture, and urban soil ecosystem restoration in particular. However, I have concerns that some of the claims of the manuscript are overstated due to the small sample size in some instances. I don’t see this as a reason to reject the manuscript, but would recommend that the authors rethink the statistical analyses and subsequent claims made from small subsets of the data (n=3). In those cases, visualizing the data, describing the general trends, and considering possible explanations and considering future experiments to understand them would be more appropriate.

Also, it’s worth considering that although “no statistical difference” can be challenging in the world of publication, for an urban farmer finding the same outcomes without using tillage, or through a variety of cover crop mixes, could mean flexibility, or cost and time savings along with the ecological benefits of no-till practices. In my opinion, because these results still have a place in the published literature.

In the long run, this study would benefit from a sample size large enough to examine the tillage-by-cover crop interactions to more clearly guide the techniques employed by farmers, but that is not possible with the sample size of the current experimental design.

The clarity of the manuscript could be improved if the authors reconciled some word choices throughout the manuscript.

1. When describing soil compaction, sometimes the authors use “lower depth” and other times they use “greater depth,” when in both cases they mean deeper or more deeply. Consistency in terminology would be helpful.

2. In all cases, species “diversity” should be replaced with “richness”, since “diversity” implies an aggregate measure of species richness and evenness, typically estimated using a diversity index, while “richness” is understood to be the number of unique species in a given area

3. Sometimes the authors describe the impact of tillage as “disturbance” and other times it is described as high, moderate or no intensity. I would recommend using tillage intensity for consistency.

Scientific names of cover crop species are missing from the manuscript.

Several of the papers referenced in the text are missing from the References section.

**Title** -- The title would be more descriptive if the word “performance” was replaced with “function” or perhaps “ecosystem” since the study measured biotic and abiotic responses to tillage and cover crops

**Abstract** -- Overall, the abstract accurately reflects the study.

Ln 20 replace “emergence” with “richness”

Ln 24 replace “highest” with “fastest”

Ln 27 “lower” infiltration is confusing. I think you mean slower, but I am unsure. The same is true with “higher” compaction. I think that you mean the compacted layer was deeper in the ground.

**Introduction**

The authors make a good case for the need to understand techniques and strategies for urban soil restoration, and why compost application alone might not be sufficient and could even be detrimental to soil restoration efforts. Because urban growing spaces are often smaller and farmers might not be able to use or have access to a tractor, it’s logical to investigate the impact of rototilling and no-till methods to remedy soil compaction.

The use of cover crops to improve soil compaction and other soil quality parameters has gained wide-spread attention in the agricultural literature, but their use in urban agricultural systems is still limited. The stated benefits of cover crop use are many; however, this section could be improved with additional references from the literature to support the claims.

Ln 77 replace “sealed” with “impervious”

Ln 88-89 Revise for clarity. As is, it implies that you measured the vigor of all of the cover crop species, rather than looking at the yield of a specific crop within the mixture.

**Methods**

Overall, the methods are clear and the procedures could be repeated. However, not all subplots were used to test all hypotheses or to make all statistical comparisons. As such, the clarity of the manuscript would be markedly improved if the authors specified the sample size, the particular plots and the statistical test used for each comparison in the text and in a table.

As mentioned above, I have concerns about the appropriateness of some statistical tests based on the size of the samples used to make the comparison. Specifically, the use of a Kruskal-Wallis test for samples sizes of 3 or 4 seems too small for reliable comparisons.

Ln 104 perhaps the EPA standard should be referenced instead?

Ln 110 Table 1 Although the full results of the soil analyses are interesting, this could be reduced by reporting only the most relevant results or moved to supplementary material if need be.

Ln 115 Replace “disturbance” with “tillage treatment”

Ln 125-126 abbreviations should also be to the cover crop section

Ln 129 It is not clear when in the experiment the tillage occurred relative to planting cover crops, etc.

Ln 154 include brand/maker of the soil penetrometer

Ln 155 Where were the compaction samples taken from the subplots and how were they selected?

Ln 154-159 Combine

Ln 159-161 When did sampling occur relative to the tillage treatment?

Ln 167 metric units should be stated first

Ln 169 where in the subplot was the infiltration test performed?

Ln 171 Need volume, not mass of aluminum can

Ln 173-182 Methods for estimating weed cover % are not mentioned, while weed species richness is mentioned twice.

Ln 183 Need to explain that forage radish was part of the compaction mix, but was monitored like a food crop as a way to measure effects of treatments on yield.

**Results**

Ln 202-206

*There is mention of the use of ANOVA to examine the difference in soil compaction between tillage treatments and the results of that test is reported here. But there are also what looks like t-statistics (with too many degrees of freedom reported), implying perhaps a post-hoc test, but there is no-mention of any post-hoc tests in the methods section.*

*Ln 202 The results of ANOVA do not say which treatments are different, but only whether there is or isn’t a statistical difference. Revise this statement.*

Ln 204 Figure 2 does not represent the statistical comparison as it is stated in the text. Ln 219-220 Reiterate which subplots were used in this analysis.

Ln 224 omit “rain”

Ln 239 Provide data to explain and support this claim.

Ln 255-260 Weed cover is not mentioned in the figure caption

Ln 263-264 Reiterate which subplots were used in this analysis.

Figures 2-5 omit means an error bars, since the sample sizes are small enough that they are not helpful. Also, the statistical tests employed (Kruskal-Wallis) in most are ranking tests than means comparisons.

Figure 4 Null should be first category on the x-axes of these plots DONE FOR FIG1

**Discussion**

The discussion could be improved by reviewing the background and the question/hypotheses of the study, before discussing the particular findings. Afterward, it would also be useful to discuss the potential future experiments that come from these research findings.

Ln 277 Clarify what you mean by “...reached similar depths..” Do you mean had similar compaction patterns or had compaction at similar depths?

Ln 279 “foliage responded better” needs to be more specific; also replace “that” with “than” Ln 283 “named” should be replaced by “planted with cover crops”

Ln 297 Reword “greater loss in compaction depth” for clarification

Ln 299 Examples of weather conditions?

Ln 301 Be specific about other studies that are corroborated by your findings Ln 307 Reword. As it is currently written it implies that tractor and rototiller remove the debris when, most likely, it brings it to the surface, allowing it to be removed.

Ln 310-311 A future study would likely explore the interaction between tillage and cover crops, since not all plots had the same response.

Ln 320 replace “deeply disturbed” with “intensely tilled”

Ln 323 A broadfork was also used, right?

Ln 328 Replace “to infiltrate water” with “for water to infiltrate”

Ln 333 Reword since soils cannot infiltrate water

Ln 335 remove comma between “compost” and “may”

Ln 360 missing “cover”