**Editorial comments:**  
The manuscript has been modified by the Science Editor to comply with the JoVE formatting standard. Please maintain the current formatting throughout the manuscript. The updated manuscript (55182\_R1\_071216.docx) is located in your Editorial Manager account. In the revised PDF submission, there is a hyperlink for downloading the .docx file. Please download the .docx file and use this updated version for any future revisions.  
  
1. Formatting: 5.1, 5.2, 5.3 – Method only should appear in the heading. The number of people required can be listed as a note.

**Revised as a note**  
2. Grammar:  
-Line 34 – “suitability…are discussed”

**Revised**

-2.3.1, 4.2.1 – Please use imperative tense or convert to a note.

**Revised**

-5.2.5 – “takes”

**Revised**

-5.2.6 – “removes”

**Revised**

-6.2.3 – “should shallow enough space’

**Revised**  
  
3. Additional detail is required: 5.1.5, 5.3.6.1 – When should samples be transferred to the freezer?

**Revised to say within 3 h of sample collection**  
4. Results: Please convert data from one of the tables to a graph to provide visual interest for the video.

**1 day after treatment data from Table 2 converted to a graph. Submitted as a PDF tiled “1 DAT data” under “Supplemental File”**  
**Reviewers' comments:**  
**Reviewer #1:**  
*Manuscript Summary:*  
The authors do a nice job of explaining the purpose of this research as well as relating how the different methods can alter findings regarding pesticide transfer.

**Thank you**  
*Major Concerns:*  
There are no major concerns with the article. The edits suggested are to improve flow or specificity with a sentence.  
  
*Minor Concerns:*  
Short Abstract  
No edits  
  
Long Abstract  
P1L38 remove inherently replace with can

**Revised**

P1L43 Experimental approaches, often used to assess pesticide transfer to humans, including…

**Manuscript revised to “Experimental approaches used to assess pesticide transfer to humans including hand wiping with cotton gloves, modified California roller (moving a roller of known mass over cotton cloth) and soccer ball roll (ball wrapped with sorbent strip) over three treated turfgrass species (creeping bentgrass, hybrid bermudagrass and tall fescue maintained at 0.4, 5 and 9 cm, respectively) are presented.”**

P1L48 change aggressive to describing how it differs as an approach

**The authors believe this is already included in this section with “The modified California roller is the most extensively utilized approach to date, and is best suited for use at low mowing heights due to its reproducibility and large sampling area. The soccer ball roll is a less aggressive transfer approach; however, it mimics a very common occurrence in the most popular international sport, and has many implications for nondietary pesticide exposure from hand-to-mouth contact. Additionally, this approach may be adjusted for other athletic activities with limited modification. Hand wiping is the best approach to transfer pesticides at higher mowing heights, as roller-based approaches can lay blades over; however, it is more subjective due to more variable sampling pressure.”**Introduction  
L63-65 an awkward sentence - consider breaking into two sentences. Remove the word stand.

**Manuscript revised to “They provide many positive societal attributes including dust control, heat dissipation, recreational surfaces and soil stabilization. However, pest encroachment may occur which requires the use of pesticide(s) to maintain the turf to an acceptable level3.”**

L67 remove inherently

**Revised**

L70 remove which can then transfer to humans.

**Revised**

L72 U. S.

**Revised**

L73 replace contaminated with treated

**The authors request leaving “contaminated”, as this was the term used in the reference.**

L75 remove remaining

**Revised**

L85 remove (across and within users)

**Revised**

L89 remove additionally

**Revised**

L92-93 remove the parenthesized information. Differences of plant parameters can be discussed later in detail.

**Revised**

L101 remove ultimately. …systems may limit the implementation…

**Manuscript revised to “Ultimately, variability between turfgrass systems inhibits the implementation of a universal method to quantify transferable foliar pesticide residues. Therefore, method selection to optimize human risk assessments should encompass pesticide-, process-, site- and species-specific criteria.”**

***This revision also applies to the following L 101-104 revision.***

L101-104 split the sentence. Good information but a runon

**Revised**

L104 change is to was

**Revised**

Protocol  
1.2) could you not use records for this; or at least state that if the area of interest does not have the appropriate records to indicate pesticide applications then sampling is required.

**Researchers may be able to circumvent sampling if records are adequately kept, and the field persistence of the compound is exceptionally well understood. However, pesticide field persistence data often varies by an order of magnitude across site-specific conditions, and researchers are going to have to take a fairly high-risk guess that the compound they are researching is no longer detectable (assuming it had been applied over the area historically). Ultimately, adding these preliminary samples is advisable in most scenarios, and does not add an appreciable workload to the project (typically six total preliminary samples; and these projects typically produce 200 to 600 samples depending on the treatment structure). The authors request not including the comment regarding pesticide application records.**

2.1) remove the parenthesis. … prior to the initiation of the experiment mow turfgrass species to the appropriate height and collect clippings.

**Revised**

2.2.1) remove …creating the worst-case scenario for subsequent transfer

**Revised**

Note: include that the proper protective equipment should be worn by applicators and nonapplicators near the test area.

**Revised**

2.3.1) would precipitation possibly wash the active ingredient off the leaf surface?

**More than likely, yes.**

**Manuscript revised to “Note: Plots are covered to prevent pesticide wash from treated vegetation into turfgrass thatch and/or the soil surface, making it less dislodgeable and underestimating exposure risk.”**

2.3.1.1) why not conduct this over a period in which there is no precipitation expected. Also some chemicals breakdown through photolysis - Covers would limit this process and possibly overestimate transfer.

**This would be ideal, but just not logistically possible in the region research is conducted. Predictable six day periods in spring to summer are rare, which is compounded when trying to repeat research over time.**

3.3) use the word control for checks. …applied to the turf

**Revised**

3.4) as described by… remove inherent …as to identify potential sources of contamination

**Revised**

4.1) ….and again once the pesticide has dried on the leaf surfaces. Depending on environmental conditions this is typically between 1 and 3 hours post pesticide application.

**Revised**

Note: …replace as often as needed to prevent contamination

**Revised**

5.1.1.2 Primarily use fingers to contact turfgrass leaves while limiting leaves from laying over.

**Revised**

5.1.1.2.1 remove parenthesis and incorporate into sentence

**Manuscript revised to “5.1.1.2.1) Prepare a 10% v/v water-based solution of green food coloring and a 1% v/v nonionic surfactant, and spray on a nonporous surface to create a thin film.**

**Note: The nonionic surfactant is used to increase solution coverage over the nonporous surface by reducing surface tension.”**  
Representative Results  
L362 awkward sentence May just want to state pesticide residues methods within turfgrass systems. This would allow the stance that the systems change due to species, soil, maintenance, etc…

**The authors acknowledge there is a lot going on this sentence, but the intention of it was to highlight that comparing transfer methods across turfgrass systems has not been documented before. Highlighting that these methods respond differently across systems is the second objective of the manuscript (first objective being how to conduct this research). The authors have included the term “single” in the sentence to improve clarity.**

**Manuscript revised to “Building on previous research efforts comparing transferable pesticide residue methods within a single turfgrass system, and turfgrass systems within a single transferable pesticide residue method, a field study (initiated May 24, 2016 in Raleigh, North Carolina, USA) was conducted to compare methods across turfgrass systems.”**

Also consider breaking the sentence into two sentences for easier reability  
L371-372 remove parenthesis and incorporate information into sentence

**Revised**

L376 covering? focused on or examining or evaluating

**Revised to “evaluating”**

L383 …compared to other transfer techniques such as…

**Revised**

L386 remove drastic

**Revised**

L388 These data emphasize the effect sample collection time and method applied have in quantifying….

**Revised**

L391 …field, it may not be as appropriate to fully characterize general human…

**Revised**

L397-402 How do the canopy dynamics affect the results. Please tie it together for the reader. Especially for nonturf grass readers. I believe a discussion here is very relevant to your case why different results and interpretations vary across the method employed.

**Manuscript revised to “Transferable 2,4-D did not vary between methods on creeping bentgrass at 1 or 3 DAT, which was the finest textured, lowest mown turfgrass evaluated. This allowed for relatively consistent sorbent material-treated vegetation contact across the three evaluated methods. 2,4-D transfer varied across methods in hybrid bermudagrass and tall fescue, with hand wiping resulting in greatest transfer. Hybrid bermudagrass and tall fescue are coarser textured than creeping bentgrass, and were mown at higher heights (5 and 9 cm, respectively), which accentuates an inherent limitation of rolling-based methods of laying vegetation over (Figure 6). When this occurs, sorbent material-treated vegetation contact can be reduced and consequently, underestimate transferable residues.”**

L406- great information and explaination

**Thank you**

L460 remove to date split sentence into two sentences.

**Manuscript revised to “Regulating agencies have not identified a specific method to quantify transferable pesticide residues from turfgrass. This research supports utilizing different methods based on site- and exposure process-specific criteria, as they all have utility for human risk assessments.”**

L462 edit sentence to allow for the positives as well as limitations of each method. I agree researchers must be aware of these benefits and limitations.

**The purpose of this paragraph is to summarize some of the main points of the research not specific to how to conduct such research. The authors believe the positives and limitations of each method is adequately covered in the following three paragraphs, where each method is discussed in more detail. Discussing at this point as suggested would be redundant if stated twice, or more confusing for the reader if all methods are discussed simultaneously. Therefore, the authors request leaving the discussion as originally submitted.**

Do not use the word aggressive.

**Merriam-Webster defines aggressive as “more severe, intensive, or comprehensive than usual especially in dosage or extent”, which we believe adequately describes the presented transfer methods interaction with the turfgrass canopy. The authors believe this will be more evident when video is provided for the reader to visualize these methods, and request using the term “aggressive” in the manuscript as originally submitted.**

Explaining each method is a good way to characterize their positives and limitations.

**Thank you**

L485 reduced

**Revised**

L503 remove robust data replace with reproducible

**Revised**

L509 remove parenthesis and incorporate into sentence.  
Would it be a good idea for technology to be developed to allow for constant pressure and repeatability?

**Yes, it would be ideal for technology to address this, and is something our program is actively investigating.**

**Manuscript revised to “This is the greatest limitation to transferable residue research relying solely on hand wiping, and future research should identify a less subjective approach that provides its unique attribute of canopy penetration while minimally laying grass down.”**

L517 remove parenthesis information

**Revised**

References  
Appropriate  
  
Photos  
I really like the photos. Well done.

**Thank you**  
  
Graphs  
Appropriate and simple  
  
*Additional Comments to Authors:*  
N/A  
  
  
**Reviewer #2:**  
*Manuscript Summary:*  
This is a very interesting paper talking about a detailed protocol for quantifying the foliar pesticide residues and the valid results based on the experiment. The main method on how to quantify the pesticide residues is addressed very detailedly. The experiment was set up using fairly practical materials and design so it can be easily repeated by other researchers, which is the key value of this research. The diagram of the instrument design is clearly demonstrated and explained.  
The authors mentioned different methods used in previous studies briefly. However, a more detailed comparison is preferred to let other researcher decide which method is best for different practice. So more information on alternative approaches should be address in the Introduction section. This is a main drawback of this manuscript.

**The authors agree with Reviewer 2 that information regarding transfer methods outside of the three specifically covered in this manuscript is limited (other than references 9-12 which provide more detail). However, covering methods outside of the hand wipe, modified California roller, and soccer ball roll is somewhat outside of the realm of this manuscript, especially considering the 6 paragraphs Introduction limit per journal instruction. We feel that the information provided throughout this manuscript accomplishes our objectives to provide information for researchers to utilize the three transfer processes covered in detail, and also highlight that researchers need to consider site conditions and the transfer process of interest when selecting a method(s). For example, the soccer ball roll described is adequate for this process and relatively light impact transfer processes, but has limited utility for an adult soccer player sliding, which would probably be better suited for a drag slide approach that is not even covered in detail in the manuscript. By providing results evaluating three methods, across three turfgrass species, and discussing factors that resulted in differing 2,4-D transferability, we feel that this latter objective was accomplished. Ultimately, the authors request omitting additional information on other transfer methods.**  
*Major Concerns:*  
N/A  
  
*Minor Concerns:*  
Line 122, the authors mentioned that the minimum dimension of the plots. The authors didn't address where does this number come from. Please insert some explanations or citations.

**Manuscript revised to “Note: Plot dimensions can vary based on site-specific conditions, but should be a minimum of 3.3 m2. This will allow for a 3.7 by 0.5 m ball travel pathway, as well as an equivalent adjacent area for foot-traffic and vegetation sampling.”**  
  
*Additional Comments to Authors:*  
N/A