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Reply

Reply to Muramoto, J.; Bolda, M. Comments on "Verteramo Chiu, L.J.; Gomez, M.I. A Tale of Two Strawberries: Conventional and Organic Open-Field Production in California. *Sustainability* 2023, *15*, 14363"

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We thank Drs. Muramoto and Bolda for their comments on the LCA study on organic and conventionally grown strawberries. Their comments and suggestions are well received and appreciated. Accordingly, we have made a revision of the paper which includes all the suggestions from Drs. Muramoto and Bolda and other minor suggestions from field experts. The new revised version reflects better the processes in the field that contribute to the LCA of both production processes.

The omission of the fumigation process in conventional production from the LCA study that Drs. Muramoto and Bolda pointed out is a crucial one. The fumigation process, which uses chloropicrin, is regulated due to its toxicity. The application process requires completely covering the production land using a Totally Impermeable Film (TIF), which is a single-use tarp. The revised version incorporates the fumigation process, which includes 336 kg of chloropicrin and a 240 kg TIF to cover the treated area. The energy required to apply the fumigant, as well as the water and diesel consumed by tractors, was included. As seen in Civancik et al. (2019) [1], ethylene vinyl acetate copolymer film was used as a proxy for ethylene vinyl alcohol film in the LCA since the libraries of SimaPro do not include ethylene vinyl alcohol film. Both plastics have similar profiles and have been shown to produce similar environmental results (Humbert er al., 2009) [2]. The environmental effect of the TIF was not very significant, although it affected all the impact categories; fumigation did increase some of the health-related impact categories (ecotoxicity) for the conventionally grown strawberries.

The comments on the organic production process were addressed as well. We eliminated manure from the organic production process and included compost. This change improved the environmental impact of organic production. Compost is environmentally neutral, according to the libraries used in the LCA study. Although some studies report that compost application increases soil carbon sequestration in row crops in California (Tautges et al., 2019; White et al., 2020) [3,4], the amount of soil carbon sequestration varies by crop system, which makes it difficult to generalize to other crop systems. Our LCA study is based on the environmental effects of the inputs and processes reported in the libraries of SimaPro.

We also revised the effect of the transportation of inputs, assuming more efficient transportation. In the original version of the paper, small trucks were assumed to transport inputs necessary for a hectare of production, not allowing for scale efficiencies. This change improved the carbon footprint of transportation for both production systems.

Input costs, including the administrative costs of fumigant regulations, are not included in the LCA study because our analysis does not consider production costs. The purpose of the LCA study is to estimate the environmental impact of production based on input use.

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Our revised results reflect the environmental, and some specific health, effects of the fumigant used in conventional production. Our study does not assess the complete human health benefits of organic compared to conventional strawberry production. The negative health impact of fumigants may be much greater than that reported because the exposure of farm workers to toxic substances needs to be considered. This exposure should be part of the dialogue and further accounted for in understanding the health effects of food production. We appreciate the timely comments of Drs. Muramoto and Bolda and hope that this revision captures more accurately the production processes of the two systems analyzed.

Conflicts of Interest: The authors declare no conflict of interest.

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