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Improvement to the Air Management Practices Tool (AMPAT)

Abstract

The livestock and poultry production industry needs a current, science-based guide for proven air quality mitigation technologies. This will ultimately help the industry to focus on mitigation efforts with the greatest impact potential. In this research, we will conduct a scientific literature review of mitigation methods and technologies for aerial emissions of odor, volatile organic compounds (VOCs), ammonia, hydrogen sulfide, and greenhouse gases (GHGs) from livestock and poultry operations. Research summaries will build on and be complimentary to the National Pork Board-funded project "Air Management Practices Assessment Tool (AMPAT)", an on-line user-friendly tool. Our work aims to:

(1) add scientific literature review summaries in addition to existing "Compilation of information on the management, effectiveness, and costs regarding the latest mitigation strategies";
(2) add greenhouse gas (GHGs) mitigation and volatile organic compounds responsible for odor to the target air pollutants in the AMPAT, and
(3) make the AMPAT tool relevant to all major livestock and poultry species. The proposed effort will add value to existing AMPAT.

The purpose of the AMPAT is to guide users through a process of determining which mitigation practices are best suited to the user's operation and user-defined objectives.

Keywords: Odor, Air Quality, Livestock, Poultry, Volatile Organic Compounds, Ammonia, Hydrogen Sulfide, Greenhouse Gas, Mitigation

Introduction

- The current AMPAT contains information that is older and contains gaps.
- Updating the AMPAT with up-to-date, scientific literature will make it a more useful resource.
- Changing the AMPAT to make it more amendable should allow for the tool to be continuously updated with new research.
- In order to implement the desired changes to the AMPAT, the scientific literature available on mitigation technologies must be compiled and reviewed.

Objectives

1. Conduct a scientific literature review to summarize research to update and enhance the Air Management Practices Assessment Tool (AMPAT)
   - Compile scientific information on mitigation strategies and technologies for odor, VOCs, NH_3, H_2S, and GHGs
   - Updated tool will benefit the users and will be easier to update in the future

2. Identify and rank research needs and knowledge gaps based on the literature review to inform future research directions based on feasibility, economics, and potential impact
   - Compilation of up-to-date information should reveal gaps in current knowledge
   - Identification of these knowledge gaps will inform follow-up research focused on mitigation strategies and technologies

3. Disseminate the educational tools created by this research
   - Make educational resources available to commodity groups (esp. in Illinois and Indiana), livestock and poultry producers, and Iowa State University Extension field personnel
   - Distribute these educational resources through the improved AMPAT website, fact sheets, presentations, posters, and peer-reviewed journals

Methodology

- The online scientific database, Web of Science, is the primary medium through which published research is being found.
- Keywords [see Abstract] are being used as search terms in our Web of Science searches.
- Peer-reviewed articles detailing research done on relevant mitigation methods and technologies are discovered and reviewed, and the desired information is extracted from them.
- The specific information to be incorporated into the AMPAT is extracted from the articles.

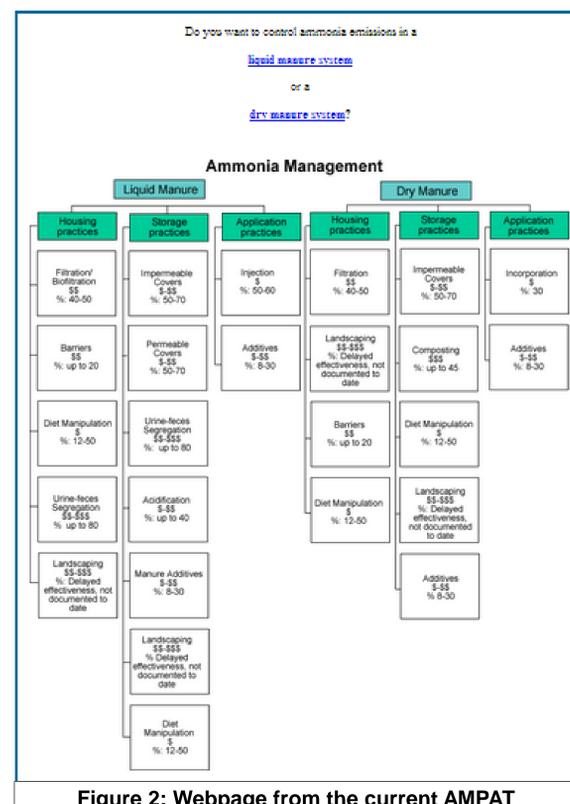**Figure 1: Literature Search and Review Methodology**

Figure 2: Webpage from the current AMPAT

- Extracted information is then compiled into the AMPAT's data table.
- Gas mitigation ranges from table can then be organized by emission, species, and mitigation technology.
- Data can then be used to update the AMPAT & identify knowledge gaps
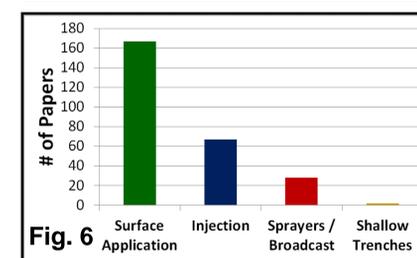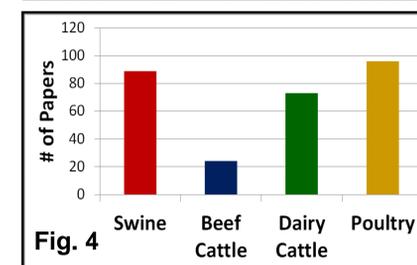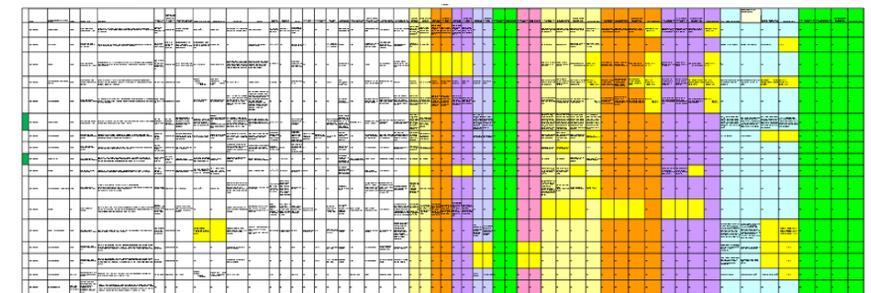
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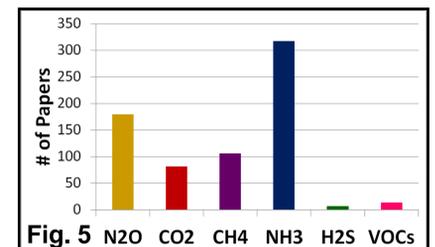

Figure 3: In-Progress AMPAT Literature Review

Fig. 4

Fig. 5

Fig. 6

Figure 4: Number of papers found regarding each species

Figure 5: Number of papers found on target gas emissions

Figure 6: Number of papers found on each mitigation technology

Preliminary Conclusions

- Literature searches turned up 89 papers regarding swine manure, 24 regarding beef cattle manure, 73 regarding dairy cattle manure, and 96 regarding poultry manure.
- N_2O emission is mentioned in 179 papers, CO_2 in 81 papers, CH_4 in 106 papers, NH_3 in 317 papers, H_2S in 7 papers, and VOCs in 13 papers.
- Surface application of manure was examined by 167 papers, injection by 67 papers, spraying/broadcast by 28 papers, and shallow trench application by 2 papers.

Future Directions

- Analysis of the current data table reveals knowledge gaps regarding dairy and poultry manure, H_2S and VOC emissions, and mitigation technologies besides for surface application.
- Future efforts will be aimed at closing these knowledge gaps, and calculating gaseous emissions reduction factors from the reviewed literature.

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