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How does farming impact air quality?

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Abstract

Farming releases small particles of pollution into the air. This lowers the quality of the surrounding air and has serious impacts on human health. In fact, air pollution caused by farming results in 17,900 deaths in the US every year! We wanted to understand more about which farming processes and foods caused the most pollution. That way we could look for ways to reduce it.

We calculated the total farming-related air pollution released in the US. We broke this data down into different categories for further analysis. We found that animal waste, fertilizer, and tilling caused the vast majority of deaths. Animal-based foods caused nearly four times more deaths than plant-based foods. Finally, we looked at interventions that could decrease air pollution. We found that changes in diet were the most effective. But farming interventions alone could lower deaths considerably.

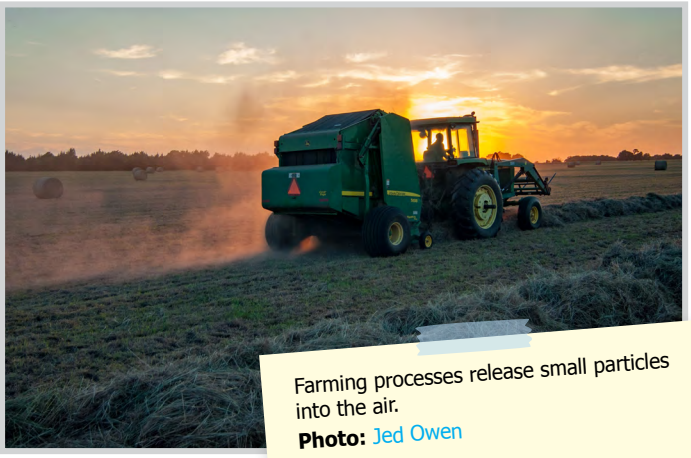
Introduction

In the last 60 years the human population has exploded! It increased from 3 billion in 1960 to 7.9 billion in 2020. To keep up with the rising demand for food, farmers have had to increase the amount of food they produce. This has led to some **farming processes** that have negative effects on both human health and the environment. Now, scientists and farmers are looking for ways to reduce these effects. But we still want to produce the same amount of food. Finding a balance between these factors isn't easy! But new research is starting to show some solutions.

One of the negative effects of farming is a reduction in **air quality**. Farming processes such as **tilling**, **fertilizer application**, and **field burning** release small particles into the air. These particles stay in the air for a long time and move around in the wind. When we breathe in these particles, they can cause serious health problems such as heart disease, cancer, and strokes. In fact, in the US alone human-caused **air pollution** results in 100,000 deaths every year. Scientists think that one fifth of these deaths are because of farming. Yet there has been very little research into farming-related air pollution.

The aims of our study were:

- to understand more about the impacts of farming on air pollution
- to find out how individual farming processes and foods affect air quality
- to come up with solutions to reduce farming air pollution.



Farming processes release small particles into the air.
Photo: Jed Owen

Methods

We investigated three questions.

1. How much air pollution is caused by farming, and where?

We looked at data from the National Emissions Inventory. We went through all their air pollution data and **extracted** all the data linked to farming. We then looked at where pollution is emitted. This is important because high **emissions** near a city impacts more people.

2. Which processes and products cause the most air pollution?

We sorted the pollution data into two main categories: farming processes and food products. We then analyzed them to work out which processes and products cause the most air pollution (Fig 1).

3. What could help reduce air pollution?

We looked at possible **interventions** that could help reduce air pollution in farming. We focused on changes that farmers can make, as well as changes that **consumers** can make.

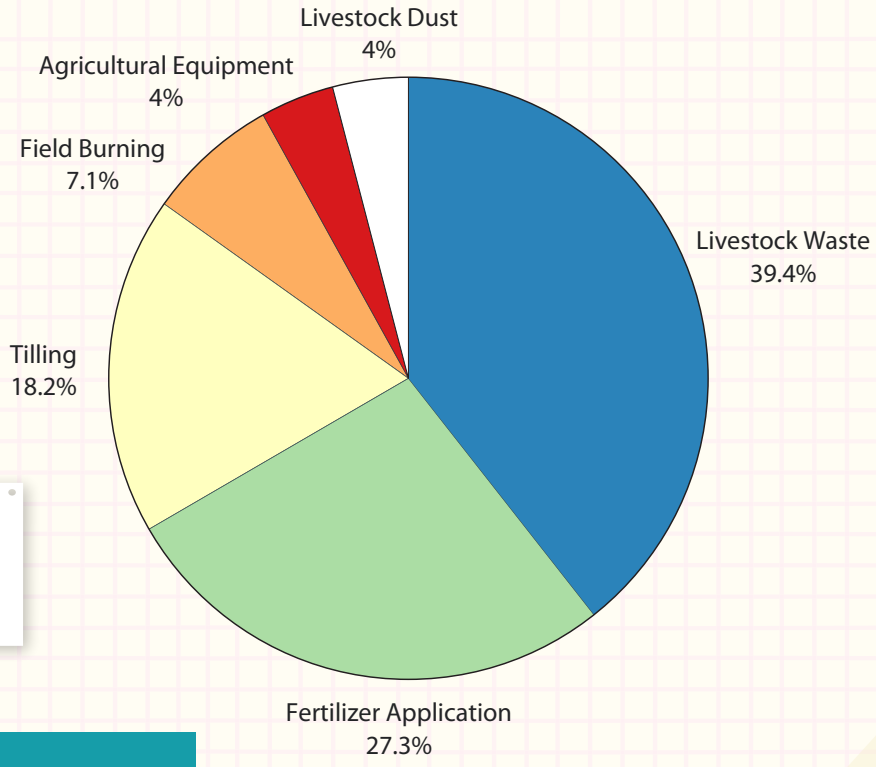


Figure 1:
Farming processes that cause the most associated deaths each year.

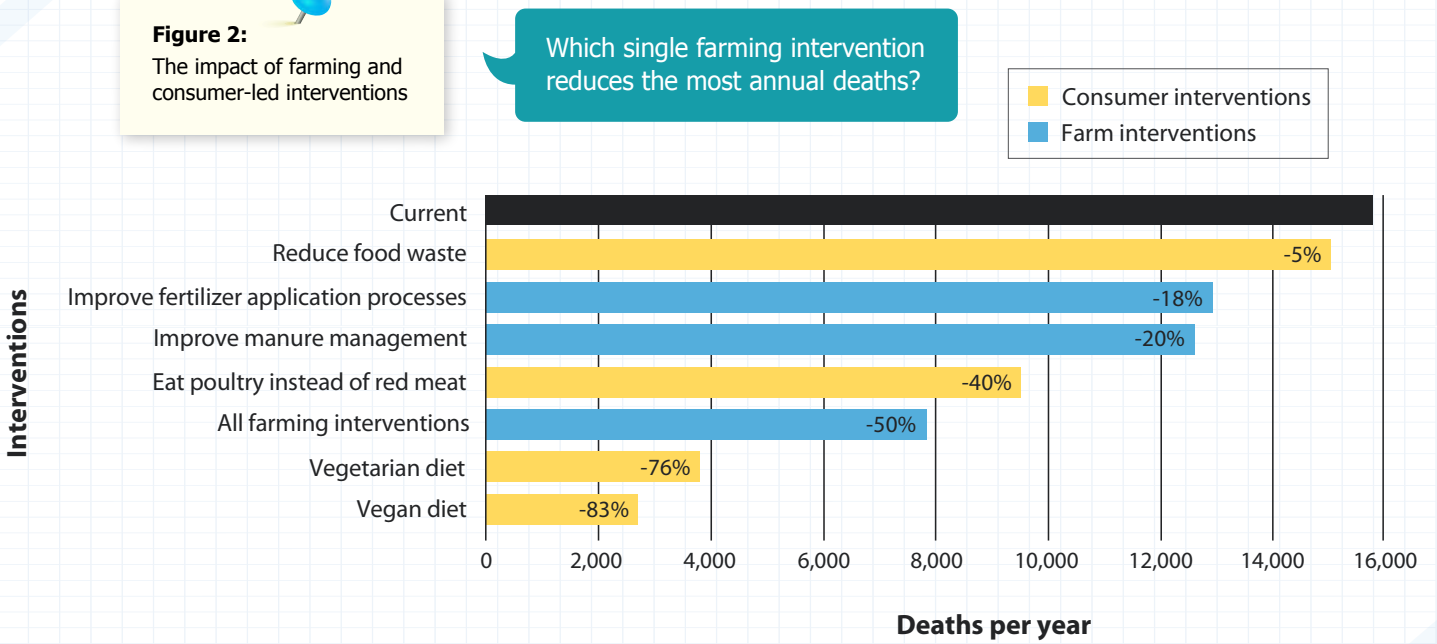
Results

Our research showed that air pollution from farming causes 17,900 deaths every year. Air pollution is highest in California, Pennsylvania, North Carolina, and along the Upper Midwest Corn Belt.

We identified eight farming processes and 67 different food products. Three farming processes cause 84% of the deaths. These were livestock waste management, fertilizer application, and tilling. We showed that animal-based foods cause 71% of deaths, with red meat contributing to 41%.

Our study showed that improvements in farming processes could potentially decrease the number of deaths by 50% (Fig 2). Improvements in livestock waste (manure) management and fertilizer application would have the largest benefits. We also found that consumer-led changes could decrease the number of annual deaths, too. Together, reducing food waste and decreasing food consumption could prevent 12% of deaths. However, dietary shifts would have the largest impact. Switching from red meat to poultry could reduce 40% of deaths, and a vegan diet could reduce 83% of deaths.

Figure 2:
The impact of farming and consumer-led interventions



Discussion

Poor air quality is the largest environmental health risk in the US. That's why we wanted to learn more about the impacts of farming on air quality. By doing this, we also found ways to reduce farming pollution. We discovered that both farmer- and consumer-led changes could decrease the number of deaths caused by this pollution.

We focused on improvements to air pollution and associated death rates. But many of the suggested changes also have extra environmental benefits. For example, decreasing food waste also lowers greenhouse gas emissions. In a similar way, some of our suggested changes have other benefits to human health. For example, eating more plant-based foods lowers your risk of developing type-2 diabetes, heart disease, and cancer.

Conclusion

It is often difficult to see how one person can make a difference to the world around you. But our research has demonstrated how much impact your decisions have! You don't have to maintain a strict vegan diet to make a difference. All you need to do is be a conscious consumer and think about what you are eating.

- Could you eat poultry instead of red meats?
- Could you reduce your meat intake by having meat-free days?
- Or could you go veggie or vegan for a week? What about a month?!

If you want to do more, you can also help by spreading the word!

- Speak to your school representatives to see if the canteen can offer more plant-based foods.
- Petition your local policy makers to encourage better farming practices.

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Glossary of Key Terms

Air pollution – unwanted chemicals or particles becoming trapped in the air and causing harm to humans and animals.

Air quality – how polluted the air we breathe is. Low air quality means there is high air pollution.

Consumer – an individual who buys products to eat or use.

Emission – the production and discharge of something into the atmosphere, such as gas, chemicals, or radiation.

Extract – draw out specific information from a larger dataset.

Farming processes – all the different processes used to successfully grow crops or raise animals. Examples include fertilizer application, field burning, and tilling, defined below.

Fertilizer application – adding extra nutrients to the soil to help plants grow.

Field burning – farmers sometimes burn the remains of old crops to get the field ready to plant the new crops. Field burning can also help to get rid of weeds and unwanted insects.

Intervention – doing something to change the outcome of a process.

Tilling – loosening and turning the soil to prepare it for crops.

Check your understanding

1. Why would farming pollution near a city have a greater human impact than the same amount of air pollution in the countryside?

2. In this study we looked at the impact of population growth on air pollution. We focused on the need to grow more food. What other environmental impacts could be caused by a growing population?

3. According to this study, what are the main benefits of switching to a plant-based diet?

4. Name a few other man-made or natural processes that can cause air pollution.

5. We found that reducing food waste would decrease the annual deaths from farming air pollution. In a group or with a partner, discuss ways to reduce food waste at home and at school.

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