Date: April 9, 2026

TO: Vermont Senate Agriculture Committee

FROM: Dr. Dave Mortensen (contact information: david.mortensen@unh.edu)

Subject: Dr. Dave Mortensen's notes from his Senate Agriculture testimony

I am writing to follow up on my testimony on Thursday morning, April 9, 2026. I want to reiterate what I said in my opening statement during our meeting, I am deeply grateful for the important work you are doing. Informed, objective, and thoughtful decision-making is critical to a healthy democracy and it's clear you are doing your due diligence on the important work issues in front of you. I indicated I would follow-up with several documents referenced during my testimony. One of those documents is a summary of my notes (contained herein), the others include the October 30, 2025 "PARAQUAT: Review of the Volatilization Potential of Paraquat from Field Uses" EPA report, and the recent Kimberly Paul paper concluding "this [epidemiological] study provides further indication that paraquat dichloride exposure increases the risk of Parkinson's disease". I have provided the references for those documents at the end of this summary and am also sending pdf's as attachments with this document.

I have included my email address should you have questions I could help answer, please don't hesitate to reach out. Thanks again for the important work you do.

From a toxicological perspective, Paraquat is an exceptional herbicide. One metric of the acute toxicity of a pesticide is the lethal dose 50 (LD 50) or the concentration of that pesticide that results in the mortality of 50% of the organisms in a controlled study. To derive the LD 50 for a given pesticide, organisms that are physiologically similar to humans are chosen as the model system organism (usually mice or rats). The populations of the model organism are then exposed to a range of concentrations of the pesticide until a concentration results in the mortality of 50% of the test population. The acute toxicity of paraquat is very high, approximately 150 mg of paraquat/ kg of test subject (depending on the formulation of the commercial product). In contrast, the LD50 for most other herbicides is the range of 2,000-10,000 mg/kg.

As members of your committee shared during our conversation, paraquat is tightly bound to the soil when it hits the bare soil. It appears that soil adsorption resulted in paraquat's manufacturer assuming paraquat is not volatile. That assumption was updated by the manufacturer when they found that volatility off surfaces other than bare soil was much higher, 4,000 times higher. One of those surfaces is plant leaf surfaces. Since paraquat is used as a "burndown" herbicide, it's intended use is on leaf surfaces. In fact, most applications of paraquat would be made when the soil isn't bare, in other words, to burn down emerged plant vegetation. For example, one would expect an apple orchard floor to have a fair amount of plant and plant residue cover at the time of spraying. The October 30, 2025 EPA report entitled *PARAQUAT: Review of the Volatilization Potential of Paraquat from Field Uses*, concludes that paraquat

"concentrations of concern" could move to distances of 4500 meters (Table 3 in the report) or 2.7 miles. This much higher potential for long distance movement increases the risk to those living near a farm where paraquat is sprayed and would help explain the epidemiological finding reported in the recent Paul et al (2024) paper where they found an elevated likelihood developing Parkinson's disease in "occupational" (applicator) and "non-occupational" (nearby resident) individuals. This is the paper reporting individuals exposed to paraquat were 64% more likely to develop Parkinson disease. These new volatility findings coupled with the toxicological properties of the herbicide make it all the more important to look to alternative herbicides and cultural and biological methods of managing emerged weeds on Vermont farmsteads.

The centrality of Integrated Weed Management. Vermont farmers rely on the use of integrated pest management to achieve their pest management goals. The New England Vegetable, and the New England Fruit Management online Guides (https://netreefruit.org/weeds/tree-fruit-herbicides-table and https://www.umass.edu/agriculture-food-environment/fruit/ne-small-fruit-management-guide/strawberries) underscore the importance of crop rotation, cover cropping, cultivation, ground mulches, and scouting (in season and in the fall) to effective weed management in crops grown in Vermont. Herbicide use practices in farming are anything but static. For example, Vermont farmers lead the New England states in cover crop adoption, an effective weed management practice. For the reporting period 2012-2017 cover crop use in Vermont increased 115% thereby reducing reliance on early season herbicide use for weed suppression.

It is important to point out that paraquat has been banned in some seventy countries including the three countries in which the herbicide is manufactured (China, Switzerland, and the UK). It is interesting to look to these countries as case studies to learn how their agricultural production was impacted. At the time the European Union banned paraquat, approximately 510,000 European farmers were using paraquat (accounting for 8% of paraquat's global sales). Brazil and China, two of the world's largest agricultural producers, were larger users and both countries went on to ban paraquat use. Where data and analyses have been conducted, there is no evidence that banning paraquat caused a significant disruption to agricultural production. In fact, positive yield trends for crops across the EU continued at the same pace post ban as they had before the paraquat ban was implemented (Stuart et al., 2022).

Interestingly, three of the top four leading apple producing countries in the world China (47,573 kilotons (kt)), Turkey (4,818 kt), United States (4,429 kt), and Poland (4,265 kt) have banned paraquat with the US being the only country still allowing it's use (https://worldpopulationreview.com/country-rankings/apple-production-by-country). To put those production statistics in perspective, China produces ten times the volume of apples the US does without paraquat. Clearly, functional, practical, and cost-effective alternatives to paraquat exist and are being used around the world. Constraining that view to the US, paraquat is used on a small fraction of cropland acres (2-8 or 10%) in most states. The very fact that 90-98% of US farmers don't use paraquat underscores the fact that functional, practical, and cost-effective alternatives exist and are used by

the overwhelming majority of US growers. Even in California where more than 90% of US strawberry production takes place paraquat use is low. The most recent data (2023) on crop specific pesticide use indicates that while California produces some 40,000 acres of strawberries annually only 30 pounds of paraquat was applied to strawberries in 2023, meaning that less than a tenth of a percent of strawberry acres were sprayed with paraquat that season. The flipside of that statistic is weeds in 99.9% of California strawberries were managed with something other than paraquat in 2023.

By the very nature of farming, farmer's are adaptable. Lessons from countries where bans were implemented suggest farmers are adaptable, turning to pest management alternatives to achieve the pest management needed to grow a productive crop.

Herbicide alternatives to Paraquat exist. One program a number of Vermont fruit growers support is the Eco Fruit Program, a program emphasizing ecologically oriented farming with pesticides used as a last resort. In addition to the Eco Fruit Program, Vermont has the largest proportion of organic farms per capita in the country at 82 organic farms per 100,000 residents. Of the approximately 10,000 acres of vegetables and fruits grown in Vermont, some 2,000 were managed organically in 2022. Therefore, a full 20% of Vermont's vegetable and fruit acres are managed without the use of synthetic organic pesticides including the use of paraquat.

When a farmer moves to use herbicides, they have many to choose from. Some cropping systems may have fewer herbicide options than others however even in crops like fruit orchards or bedded strawberries where tillage isn't easily implemented a good many herbicide alternatives to paraquat exist. A helpful resource to gain some perspective on these options is found in the New England Fruit Management Guide mentioned earlier (https://netreefruit.org/weeds/tree-fruit-herbicides-table and https://www.umass.edu/agriculture-food-environment/fruit/ne-small-fruit-management-guide/strawberries/weeds/table-26-weed-management-in-strawberries). While carfetrazone-ethyl, glufosinate, and glyphosate are commonly used alternatives (along with physical suppression of suckers) at least 8 other compounds could be used alone or in combination to achieve weed control in recently established and established orchards.

Label constraints make it near impossible to safely handle and apply paraquat. Your article https://www.ewg.org/news-insights/news/2025/07/ewg-frequent-violations-paraquat-use-pennsylvania-point-health-risks aligns with what I observed on-farm AND testimony I've reviewed for a good many Parkinson's cases, farmers have a hard time adhering to the constraints of the label and those constraints are more difficult to adhere to in warmer production regions. Farmers prefer to avoid wearing a tyvek suit and a respirator in exceedingly hot weather. Paraquat has a reputation among farmers and applicators to be a "nasty" or "difficult" to work with compound. My sense is these concerns arise from the requirements for protection and the consequences (acute and chronic) of exposure to paraquat.

References

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