

# Effects of Glyphosate Treatment on *C. elegans* Health: Implications for Migrant Communities with Elevated Pesticide Exposure

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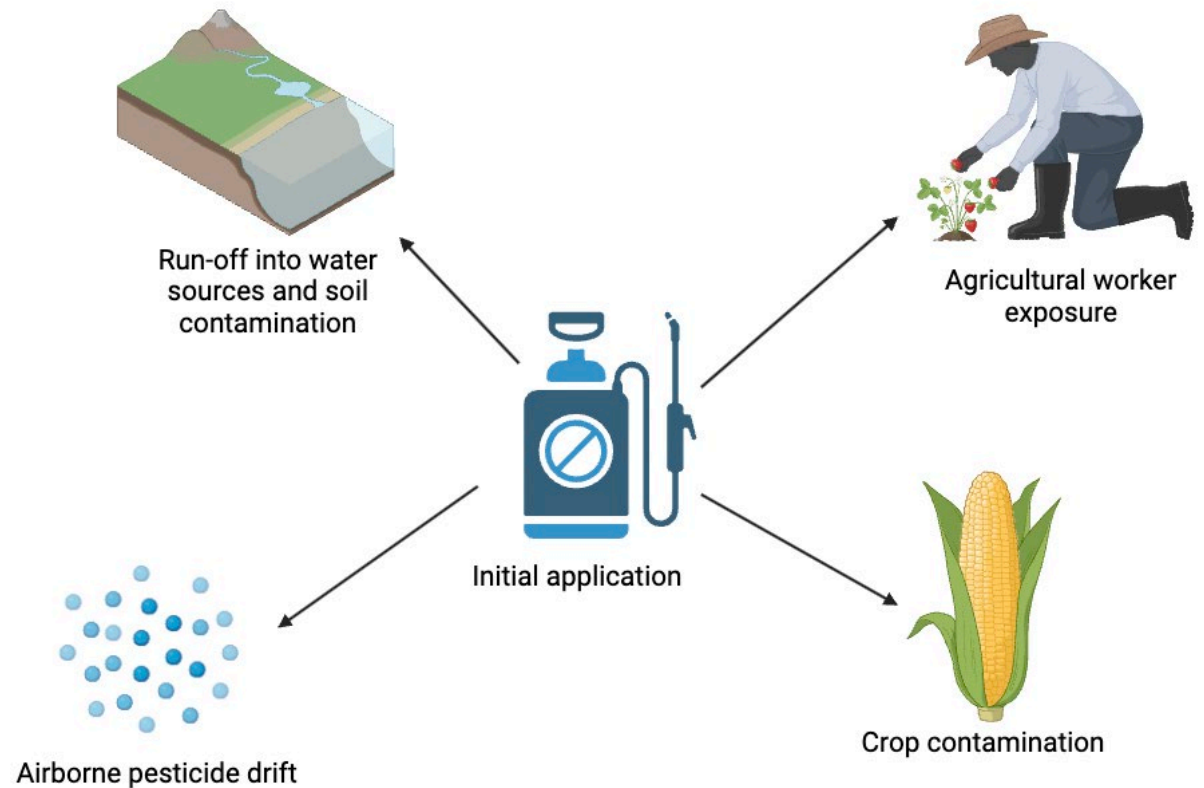
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# Pesticides: History and Context

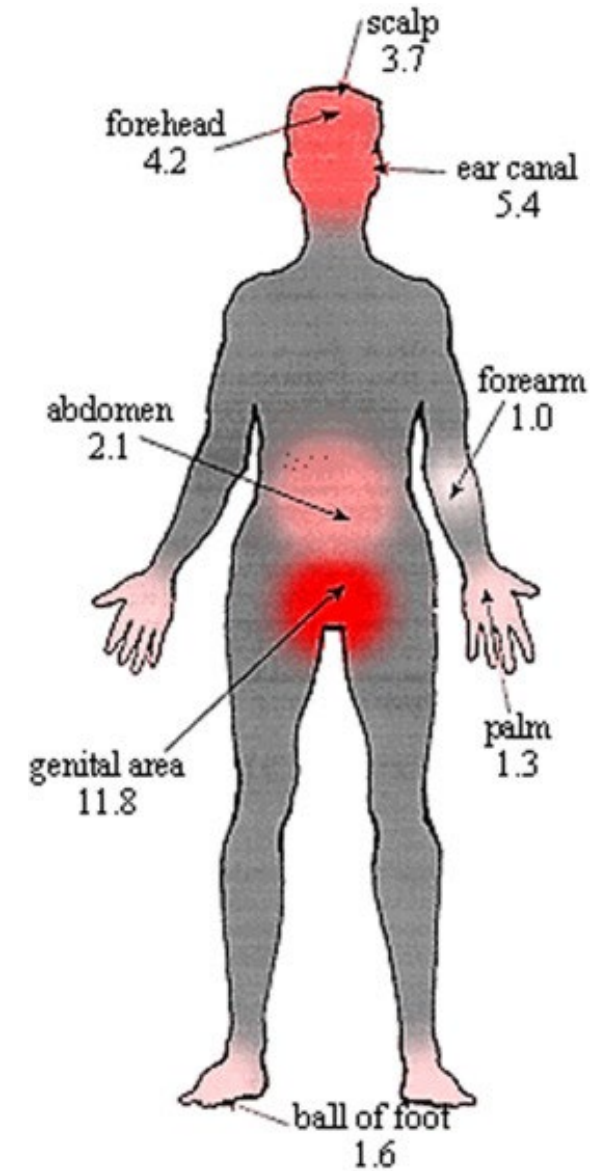
- Use has increased since WWII
  - 1930s – 579 million pounds applied per year
  - 1940s – 1 billion pounds applied per year
  - Now – more than 1 billion pounds applied per year
- Many pesticides have demonstrated undesirable/dangerous side effects



**Figure 1: Routes of first and second-hand exposure to pesticides.**

# Pesticides: Relation to Health Problems

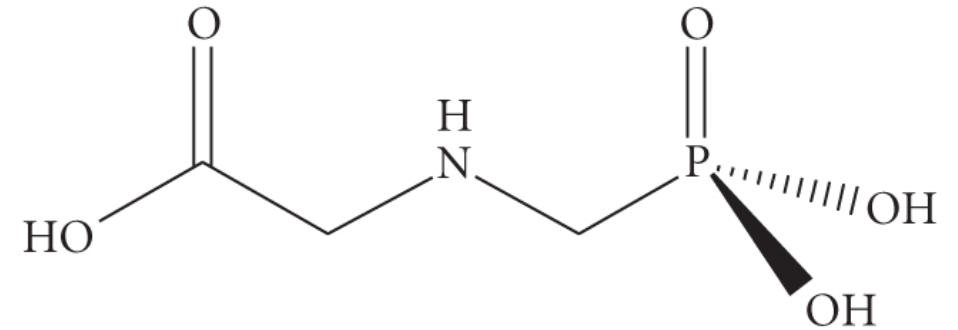
- There are many routes of exposure
  - First-hand vs. second-hand
  - Physically – skin, eyes, ears, mouth, etc
- 2 types of exposure
  - Acute – brief
    - Nausea, vomiting, rash, etc
  - Chronic – constant
    - Asthma, cancer, reproductive issues, etc



**Figure 2: Relative absorption rates of various skin locations, compared to the forearm.**

# Pesticides: Glyphosate

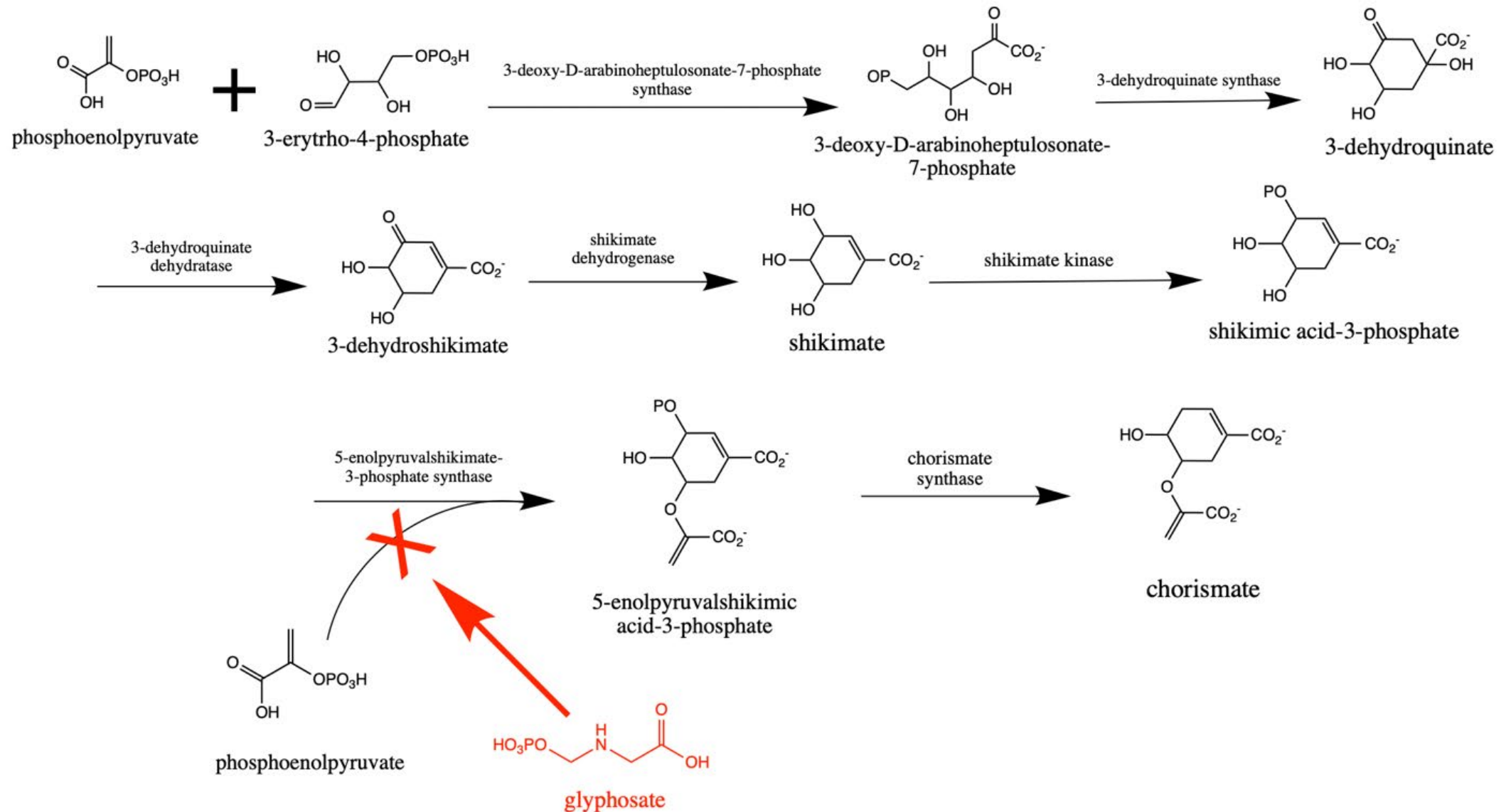
- The active ingredient in Roundup and Touchdown
- The most used herbicide worldwide
  - California: 4.8 million acres treated, and 10.5 million pounds applied
- Target Organisms
  - Plants, weeds, some species of bacteria
  - Targets the Shikimate Pathway – only exists in the target species
- Conflicting evidence exists about toxicity



**Figure 3: Chemical structure of glyphosate (top). Glyphosate is the active ingredient of Roundup and Touchdown (bottom).**



# Glyphosate Mode of Action





# Research Questions

How does chronic glyphosate treatment effect the health of *C. elegans*?

How has pesticide abuse affected migrant farming communities, both physically and culturally?

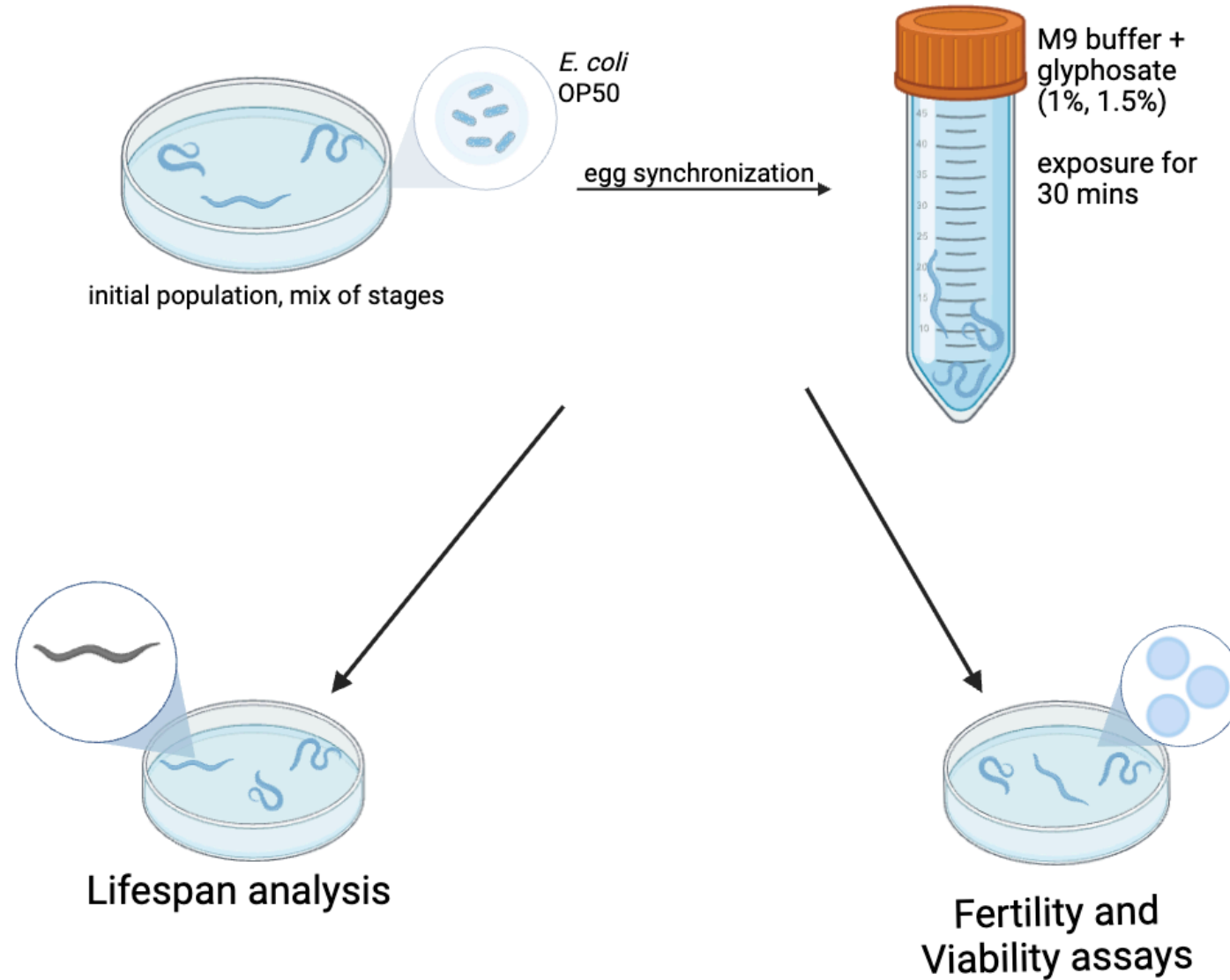


# Research Questions

**How does chronic glyphosate treatment effect the health of *C. elegans*?**

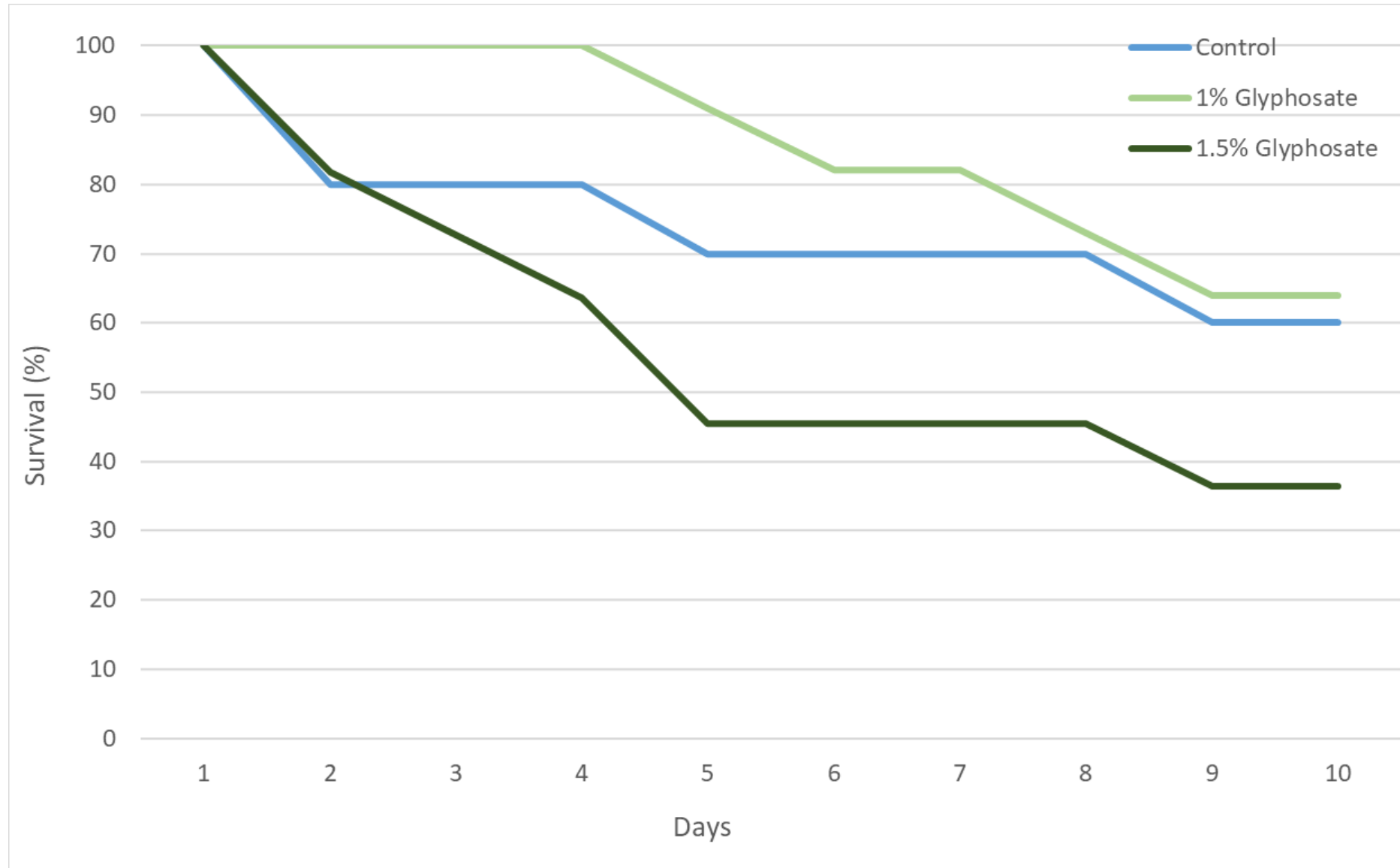
How has pesticide abuse affected migrant farming communities, both physically and culturally?

# Methodology

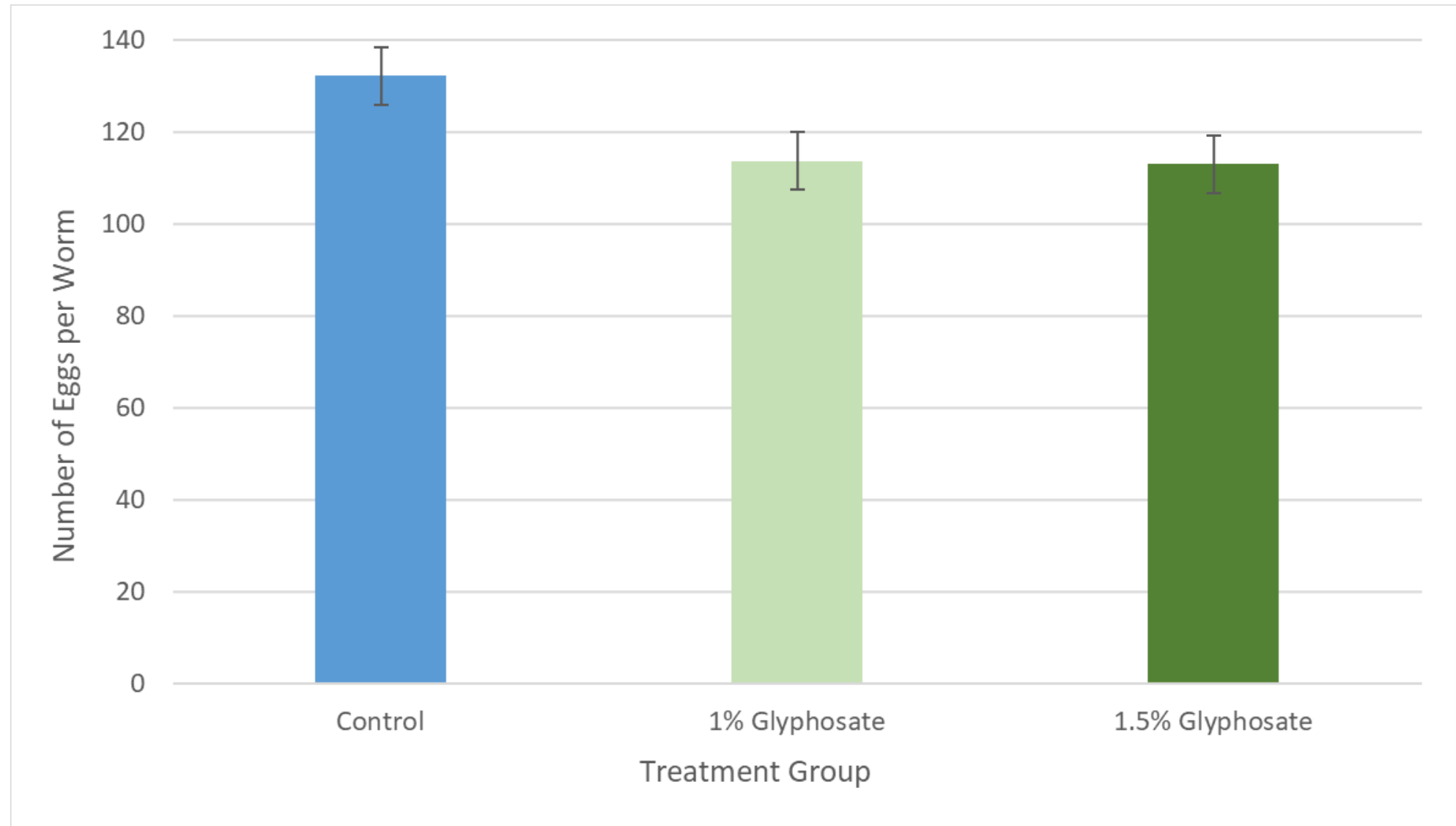




# Chronic glyphosate exposure does not significantly impact lifespan of *C. elegans*



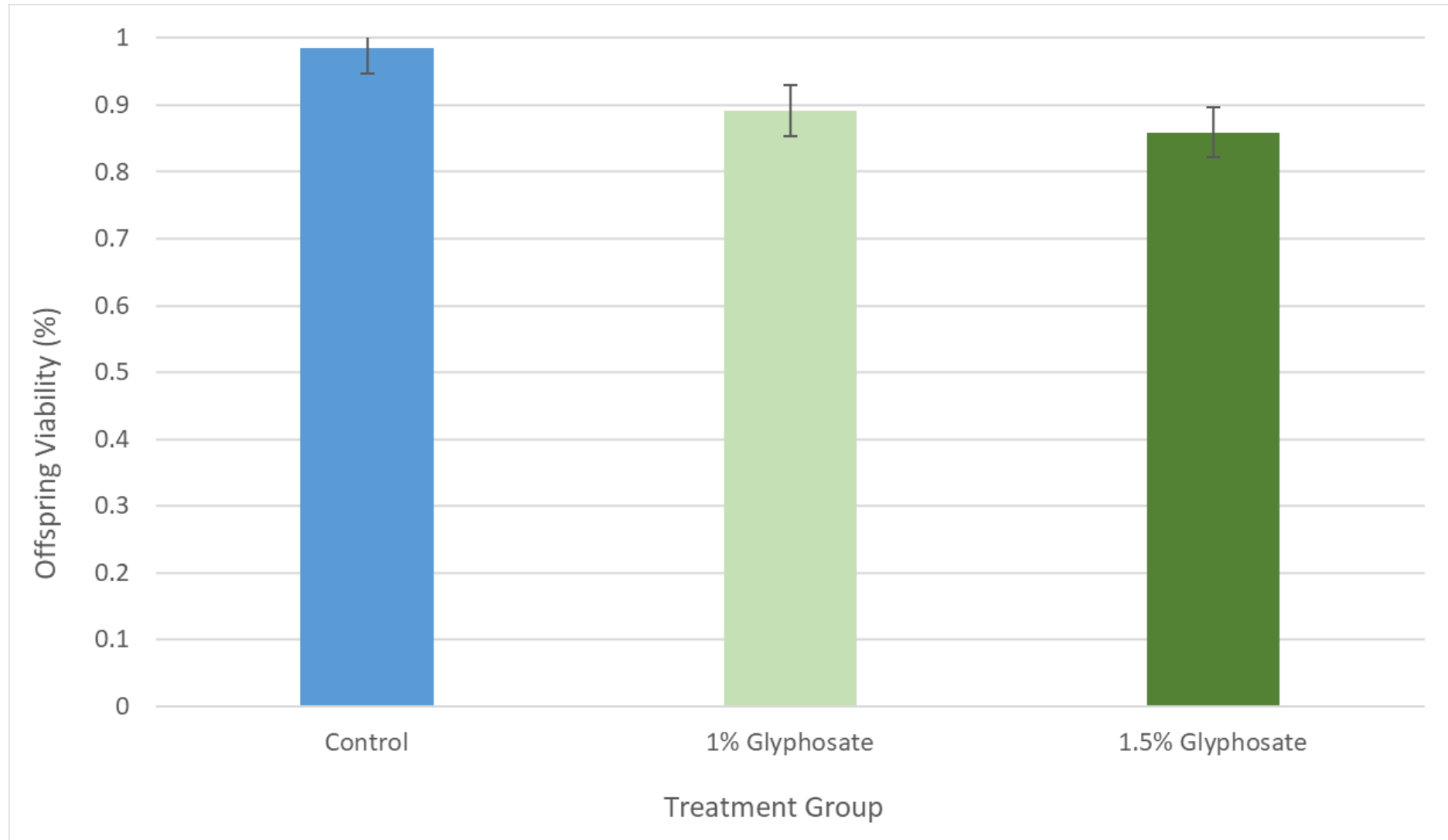
# Chronic glyphosate exposure significantly reduces the fertility of *C. elegans*



p = 0.00035



# Chronic glyphosate exposure significantly reduces the viability of *C. elegans* eggs



p = 0.0038



# Future Directions

- Additional physiological analysis
  - How does chronic glyphosate exposure at different life stages impact fertility (L1 vs adult)?
  - How does fetal exposure impact development?
- Genetic analysis
  - How does expression of cancer-associated genes change under chronic exposure?
    - *egl-1*: apoptotic activator gene
  - How is DNA damage effected by chronic glyphosate treatment?



# Research Questions

How does chronic glyphosate treatment effect the health of *C. elegans*?

**How has pesticide abuse affected migrant farming communities, both physically and culturally?**

# The Chicano movement: Chávez, Huerta, and the UFW

- The UFW – the United Farm Workers
- Fought for the rights of agricultural workers across the U.S.
- César Chávez and Dolores Huerta – the faces of the movement
  - Pushed for profound changes in the farms
  - Organized strikes that had large effects
  - Brought attention to the overuse of pesticides and the heightened exposure of agricultural workers






# Literary Analysis: *Heroes and Saints*

- Tells the story of a town of migrant workers during a health crisis most likely caused by pesticides
- Explores the impact of pesticide abuse on migrant communities, from both a physiological and cultural perspective
- Moraga heavily uses **hyperbole**
  - Cerezita – a child born completely without a body
  - Crucifixions of dead children
- Historical context:
  - Based on a real situation
  - McFarland, CA in the 1980s – “cancer cluster”

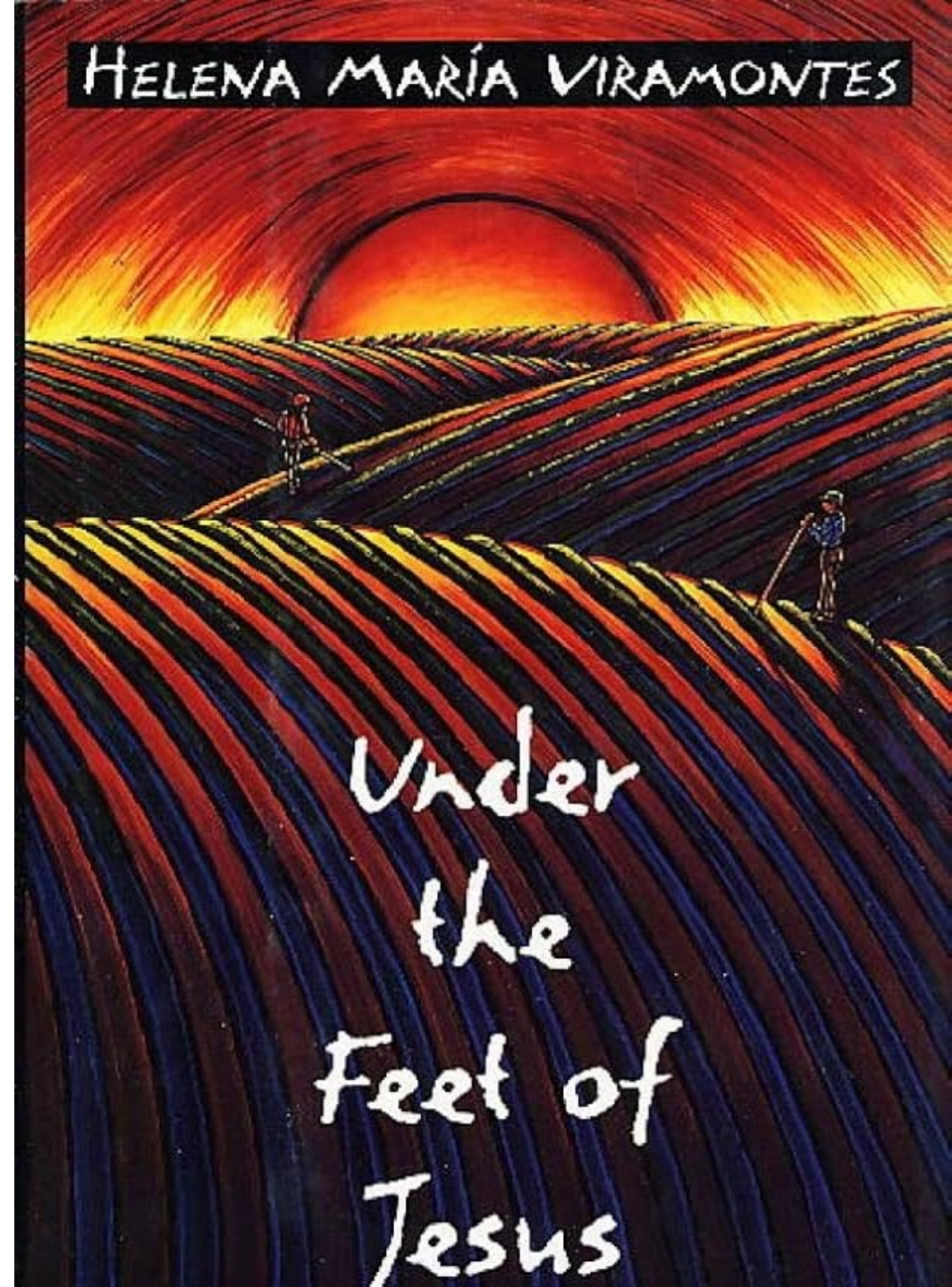





"And then I started working in the packing houses and the same thing was happening. The poison they put on the almonds, it would make you sick. The women would run out of the place coz they had to throw up. Sure, I dint wannu go back in there, *pero* after awhile you start to accept it because you gottu have a job."  
(Moraga 99).

# Literary Analysis: *Under the Feet of Jesus*

- Tells the story of a family of migrant workers and their experiences in the fields
- Explores the normalization of the dehumanization of migrant workers in the U.S.
- Recurring themes
  - Dehumanization
  - Labor conditions
  - Pesticide exposure
  - Lack of options and opportunity







"The sun was white and it made Estrella's eyes sting like an onion, and the baskets of grapes resisted her muscles, pulling their magnetic weight back to the earth. The woman with the red bonnet did not know this. Her knees did not sink in the hot white soil, and she did not know how to pour the baskets of grapes inside the frame gently and spread the bunches evenly on top of the newsprint paper. She did not remove the frame, straighten her creaking knees, the bend of her back, set down another sheet of newsprint paper, reset the frame, then return to the *pisca* [harvest] again with the empty basket, row after row, sun after sun. The woman's bonnet would be as useless as Estrella's own straw hat under a white sun so mighty, it toasted the green grapes to black raisins." (Viramontes 50).



# Conclusions

- Pesticides are agricultural tools that are very useful and necessary for our food production
  - Off-target effects need to be better understood
- Chronic glyphosate treatment can cause physiological changes in *C. elegans*
  - No change in survival
  - A reduction in fertility and viability of offspring
- Pesticide abuse has heightened effects in migrant farming communities
  - Method of control
  - Environmental racism
  - Contributed to the dehumanization of these communities



Questions?