

# Using Feed Additives to Manage Methane in Cattle

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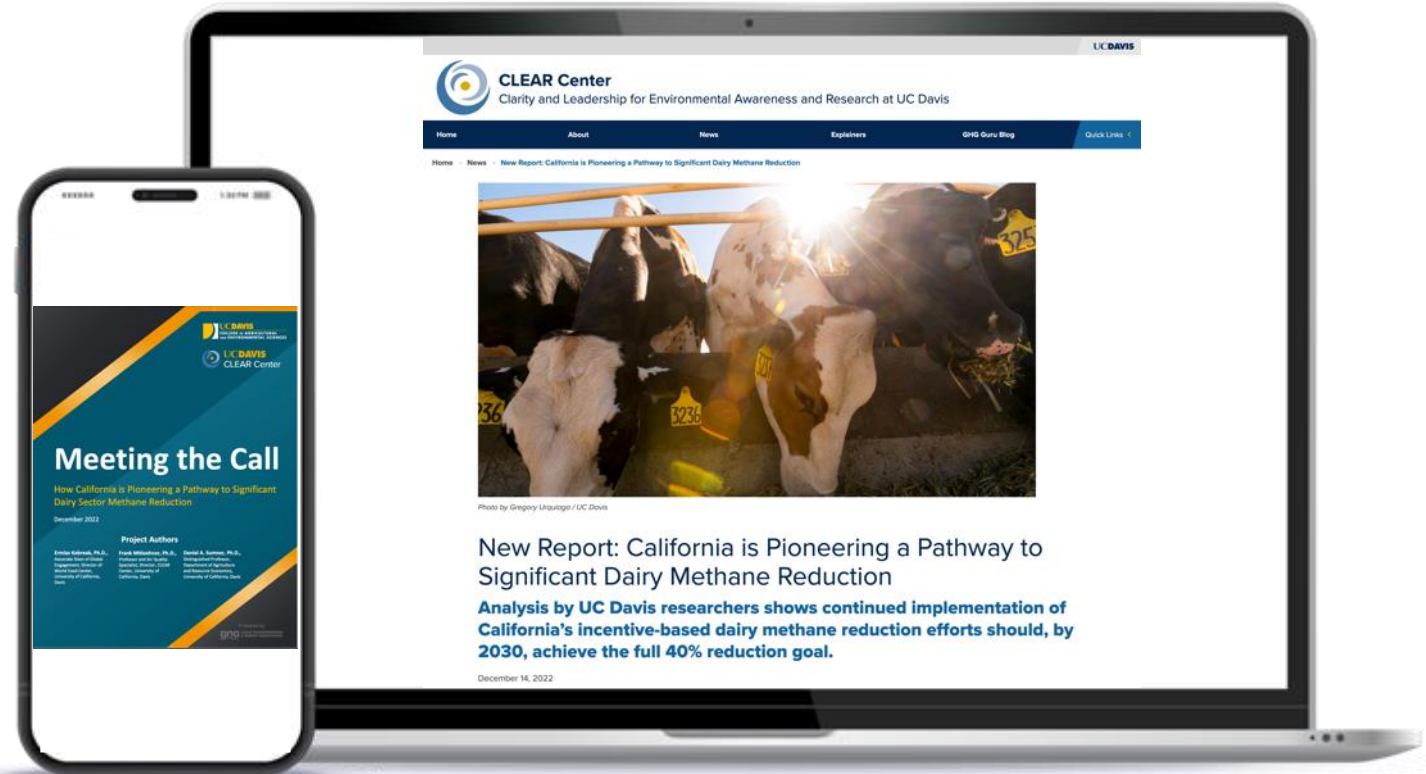


# Whitepaper highlighting benefits of incentive-based policies in GHG reductions



Use your cellphone camera to scan the QR code and take you to the article.

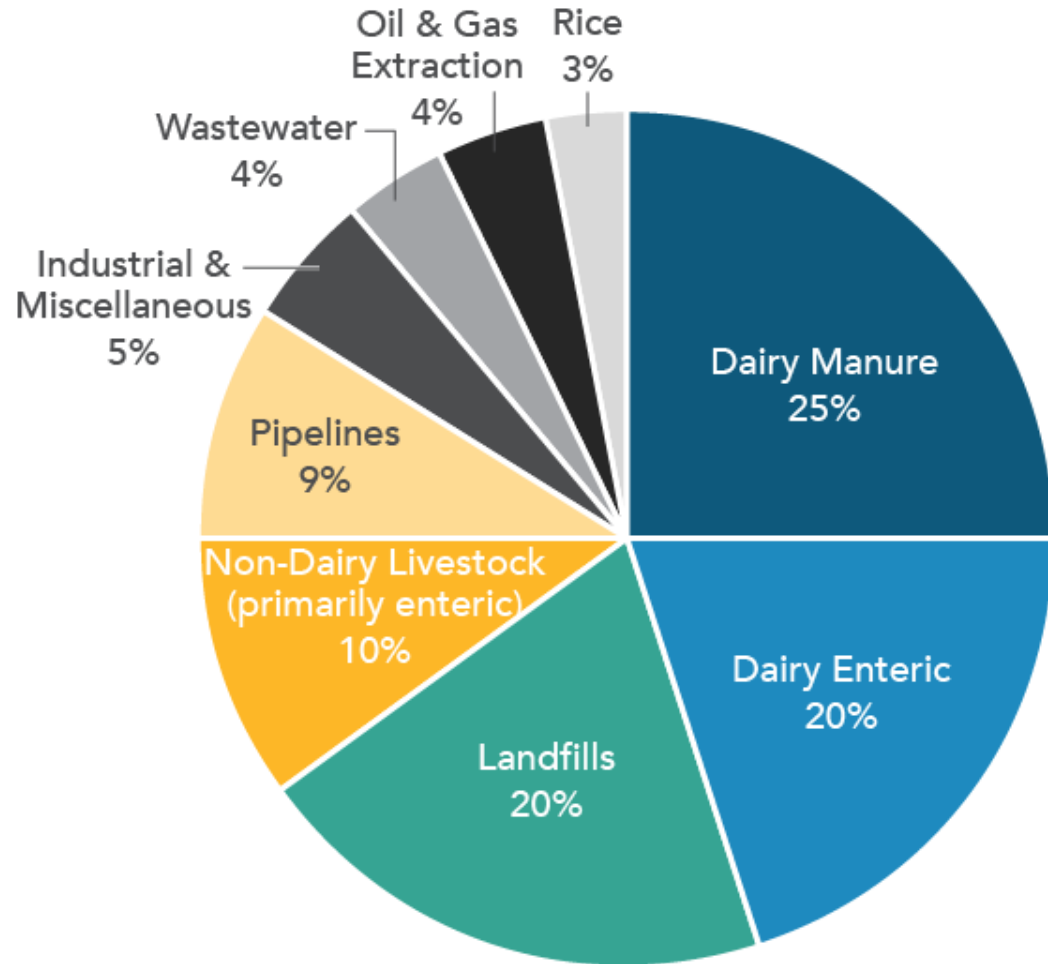
<https://bit.ly/pathwayclear>



# Ambitious Goals in California

2013 Methane: 118 MMTCO<sub>2</sub>e (20-yr GWP)

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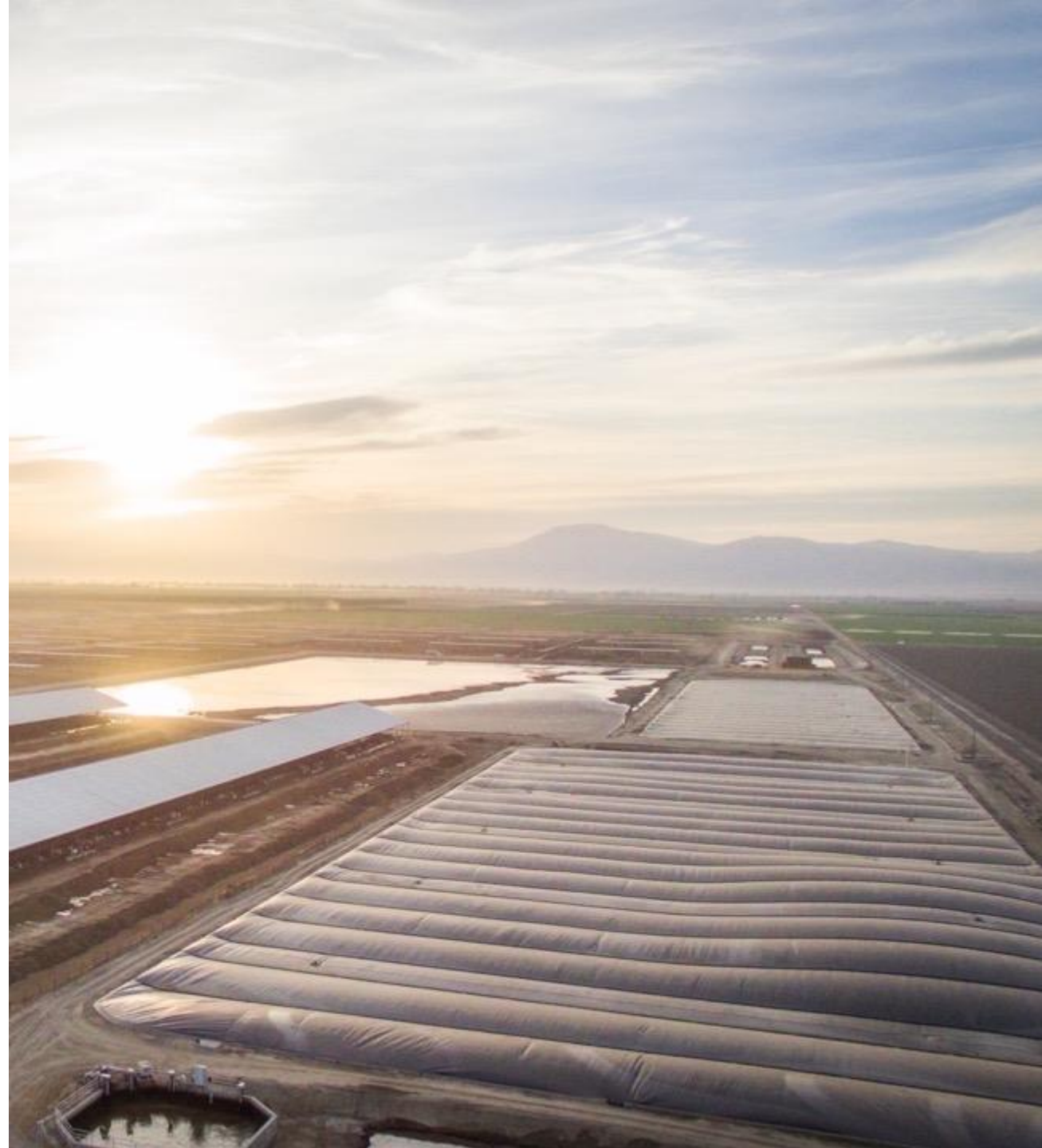
- California had set aggressive targets for reducing methane 40% below 2013 levels by 2030
- Dairy to reduce 7.2 MMTCO<sub>2</sub>e

# California dairy should exceed the full 40 percent reduction by 2030 = 7.61 – 10.59 MMT

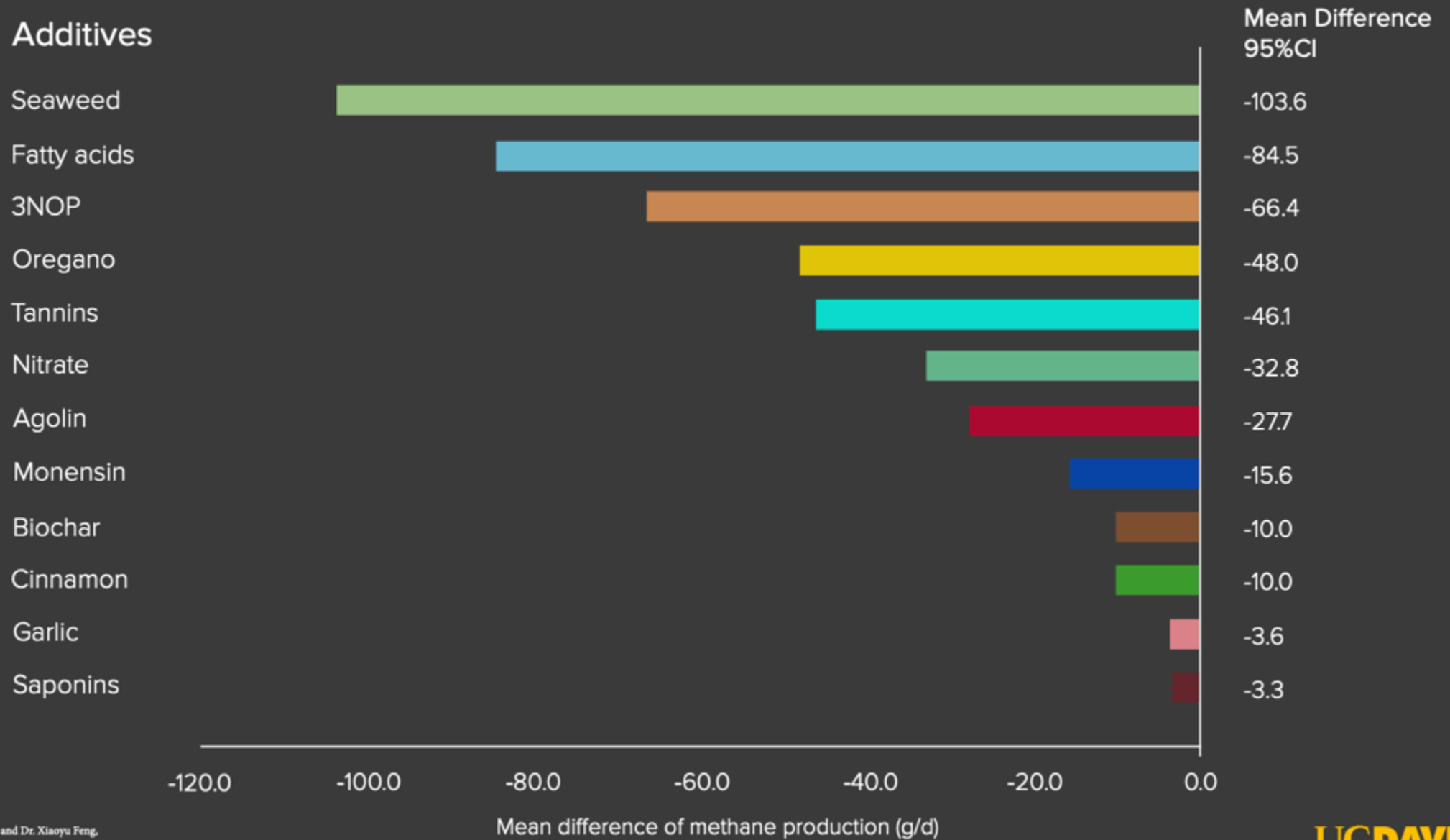
- Attrition - 2.6 to 3.3 MMTCO<sub>2</sub>e/yr
- Alternative manure management - 0.6 and 1.1 MMTCO<sub>2</sub>e/yr
- Dairy Digesters - 4 MMTCO<sub>2</sub>e/yr
- Feed additives - 250,000 MTCO<sub>2</sub>e - 2 MMTCO<sub>2</sub>e/yr



California dairies  
have reduced  
greenhouse  
gases by 4.4  
MMTCO<sub>2</sub>e –  
more than half  
of the sector's  
methane  
reduction goal.



# Methane Reductions from Feed Additives

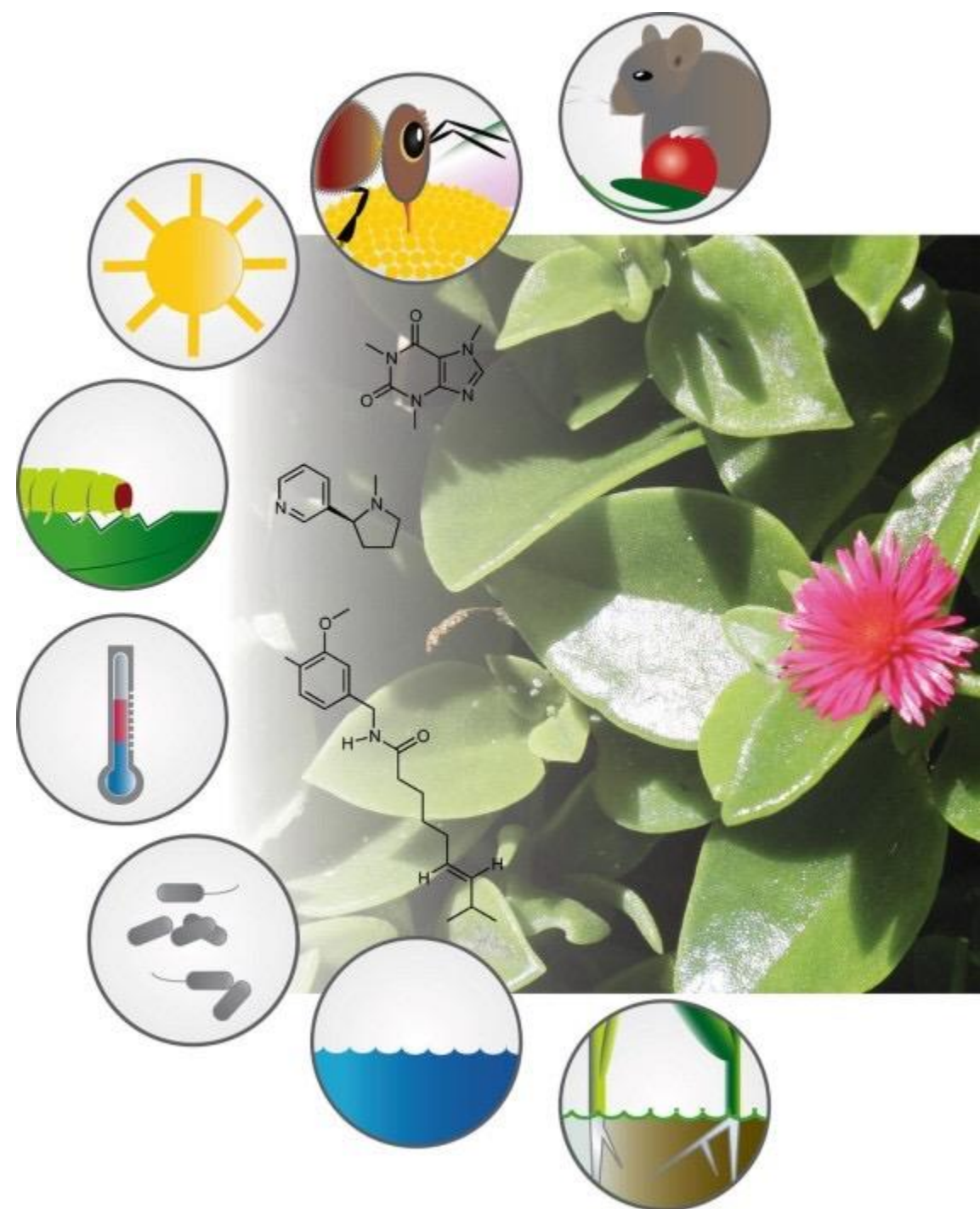


# Plant Secondary Metabolites

- Variety of bioactive compounds
- Compounds are species specific
- Do not increase plant fitness
- Essential oils, tannins, saponins, etc.

## Essential Oils

- Antimicrobial properties
- Improve rumen function
- Improve milk yield and components
- ↓ CH<sub>4</sub> emission intensity



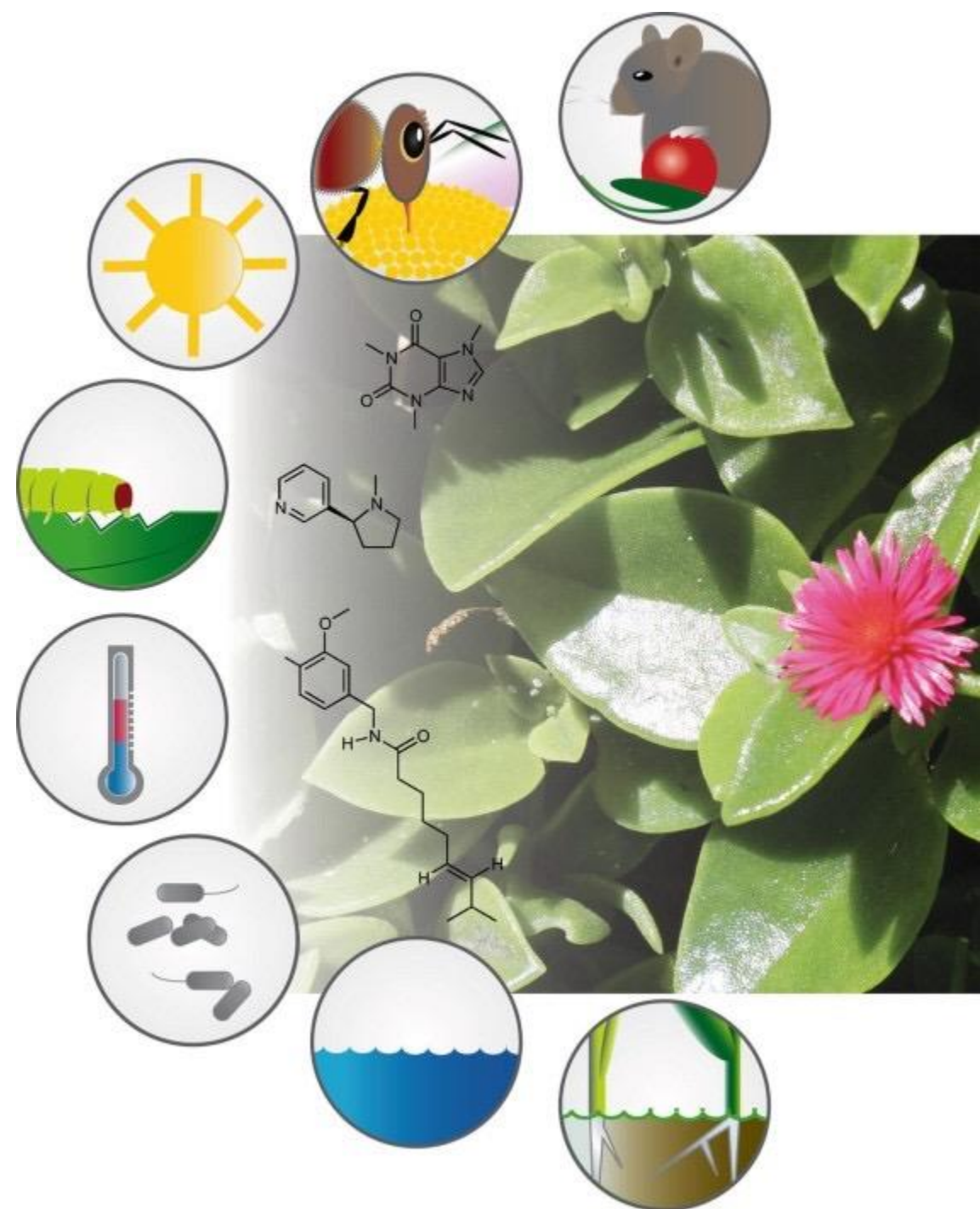


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## Tannins

- ↓ fiber degradation (Carulla et al., 2005)
- Affect ruminal protozoa (Batha et al., 2009)
- ↓ CH<sub>4</sub> emissions (Hassanat and Benchaar, 2014)
- May favorably impact animal performance (Patra et al., 2012)



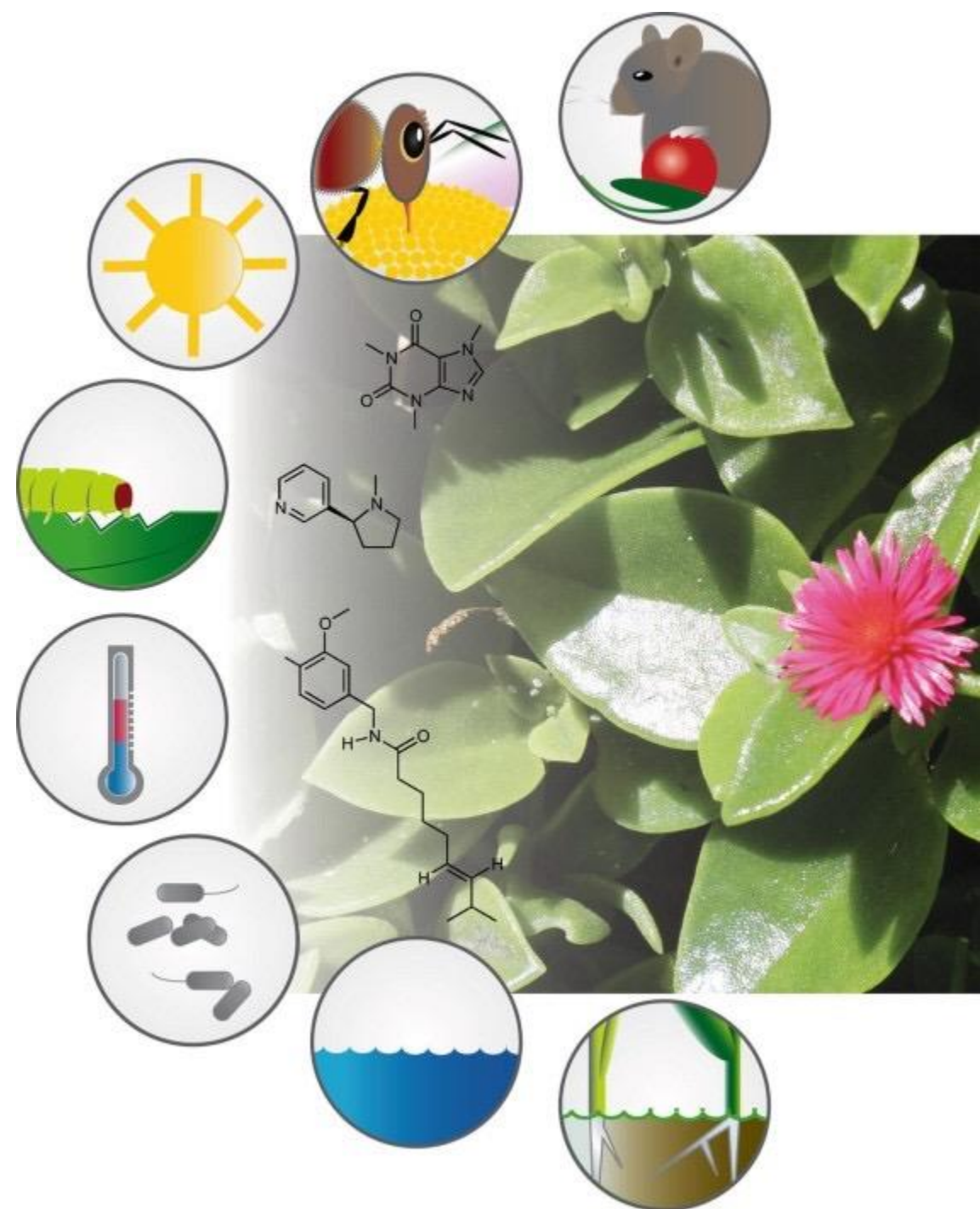


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## Saponins

- Detergent-like characteristics
- Target protozoa, fungi and select bacteria
- ↓ CH<sub>4</sub> emissions (tea, yucca, and quillaia)



# Agolin® Ruminant:

- Commercial Essential Oil blend
  - Coriander seed oil (coriander)
  - Geranyl Acetate (wild carrot)
  - Eugenol (common nutmeg)
- Improved milk yield and fat
- Reduced CH<sub>4</sub> (*in vitro* and *in vivo*)



Coriander seed oil



Geranyl acetate



eugenol



# Red Seaweed

- Strongest demonstrated methane emission reductions (up to 98%)
- Contains active ingredient bromoform
  - Inactivates the formation of methyl-CoM reductase
  - The final step in methane formation pathway



Image provided by Scheller et al., 2013 and Duin, 2013

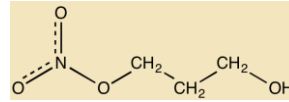


# Dairy cows will be enrolled to a 525-day intervention at the respective 3-NOP doses



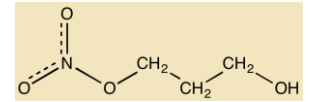
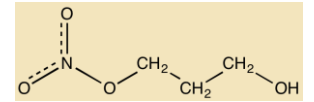
**Control (n=22)**

0 mg/kg



**Low 3-NOP (n=22)**

40 mg/kg DMI



**High 3-NOP (n=22)**

80 mg/kg DMI

60 Days



305 Day Lactation

60 Days

100 Day Lactation



Dry period



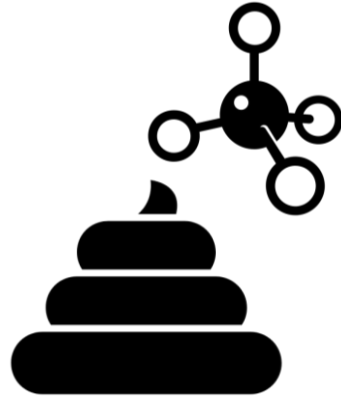
Lactation





Measure production impacts  
on dairy cattle production  
and enteric methane

1



Ensure no impact on  
manure methane yield

2



Understand mechanism  
through rumen  
microbiota insights

3



Economic and  
environmental  
implications of  
intervention

4

**Upcoming project will be the world's most intensive  
feed additive study to date to drive long-term  
sustainable milk production in California**



Thank you  
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