

# Phosphorus budgets of organic, conventional, mixed and no-input management at Russell Ranch

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Russell Ranch field day

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- Matching inputs/outputs =  $\uparrow$  P-use efficiency
- P budgets = useful to determine P balance



# Farm gate budgets



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- Important fluxes left out
  - Dust emission and deposition
  - Runoff and leaching

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  - P inputs: organic > conventional > mixed

Rainfed wheat

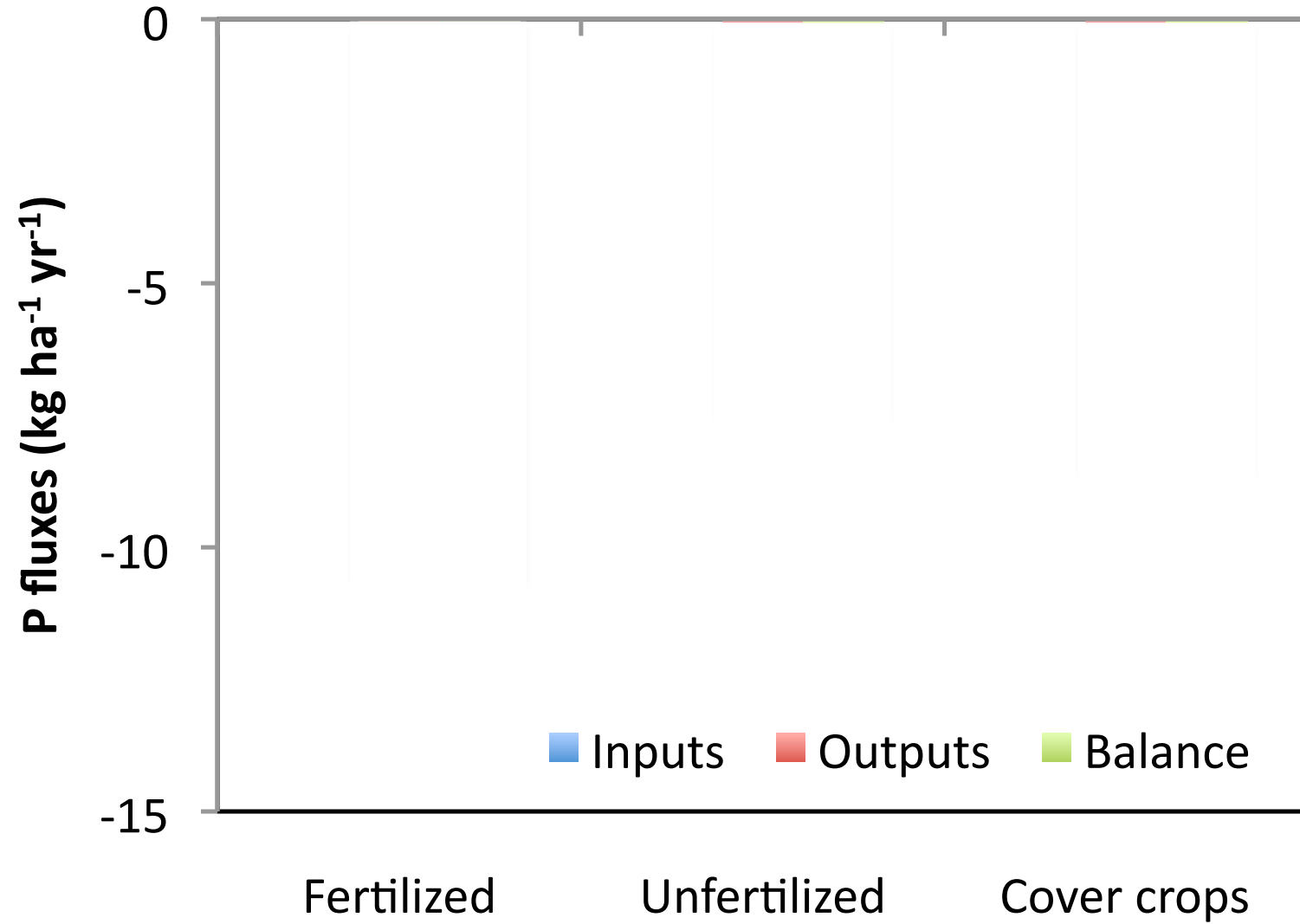
# Inputs and Outputs

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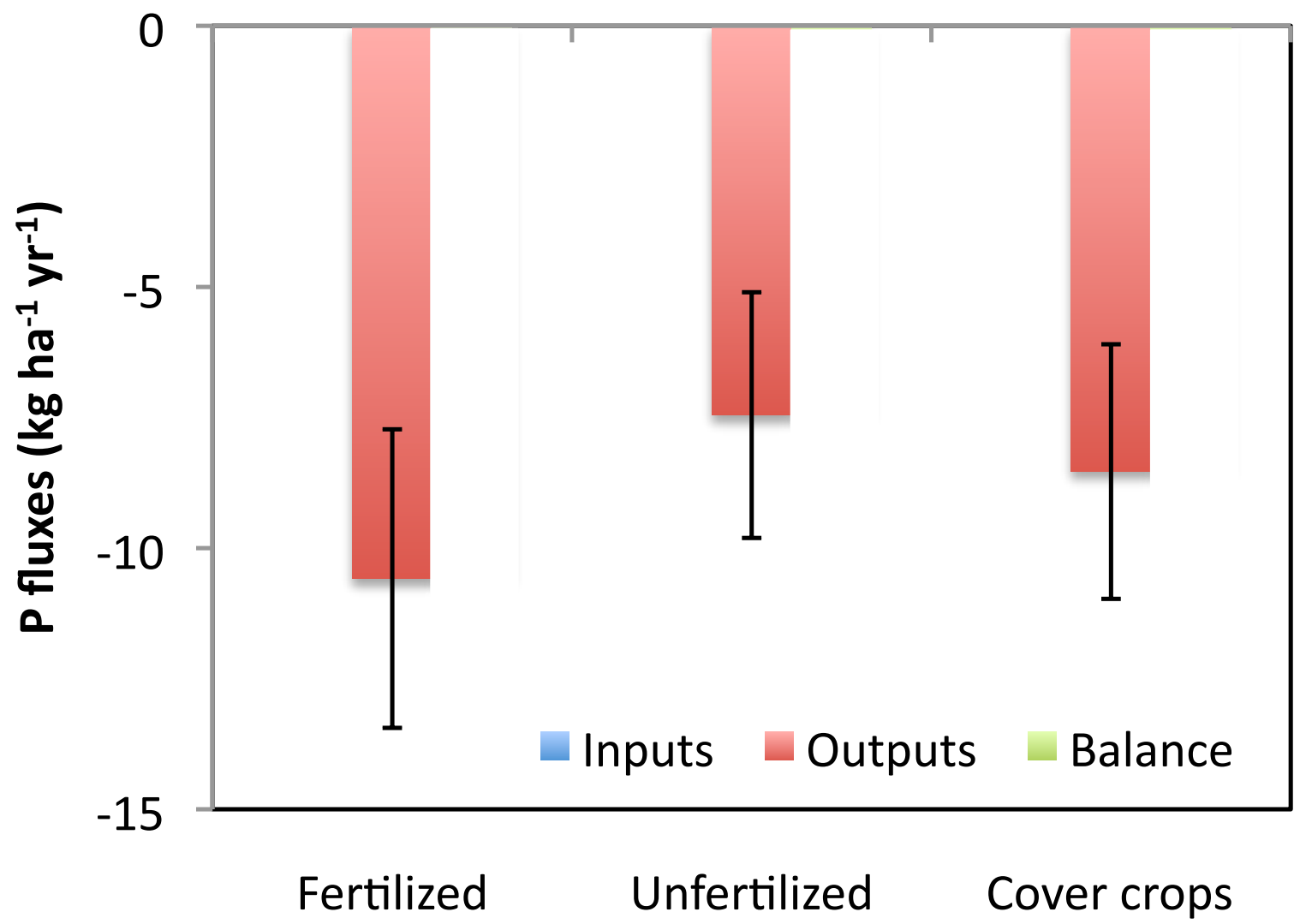
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- No inputs
- Outputs = wheat P uptake
  - Yields: Fertilized > Cover crops > Unfertilized
  - %P: Not measured

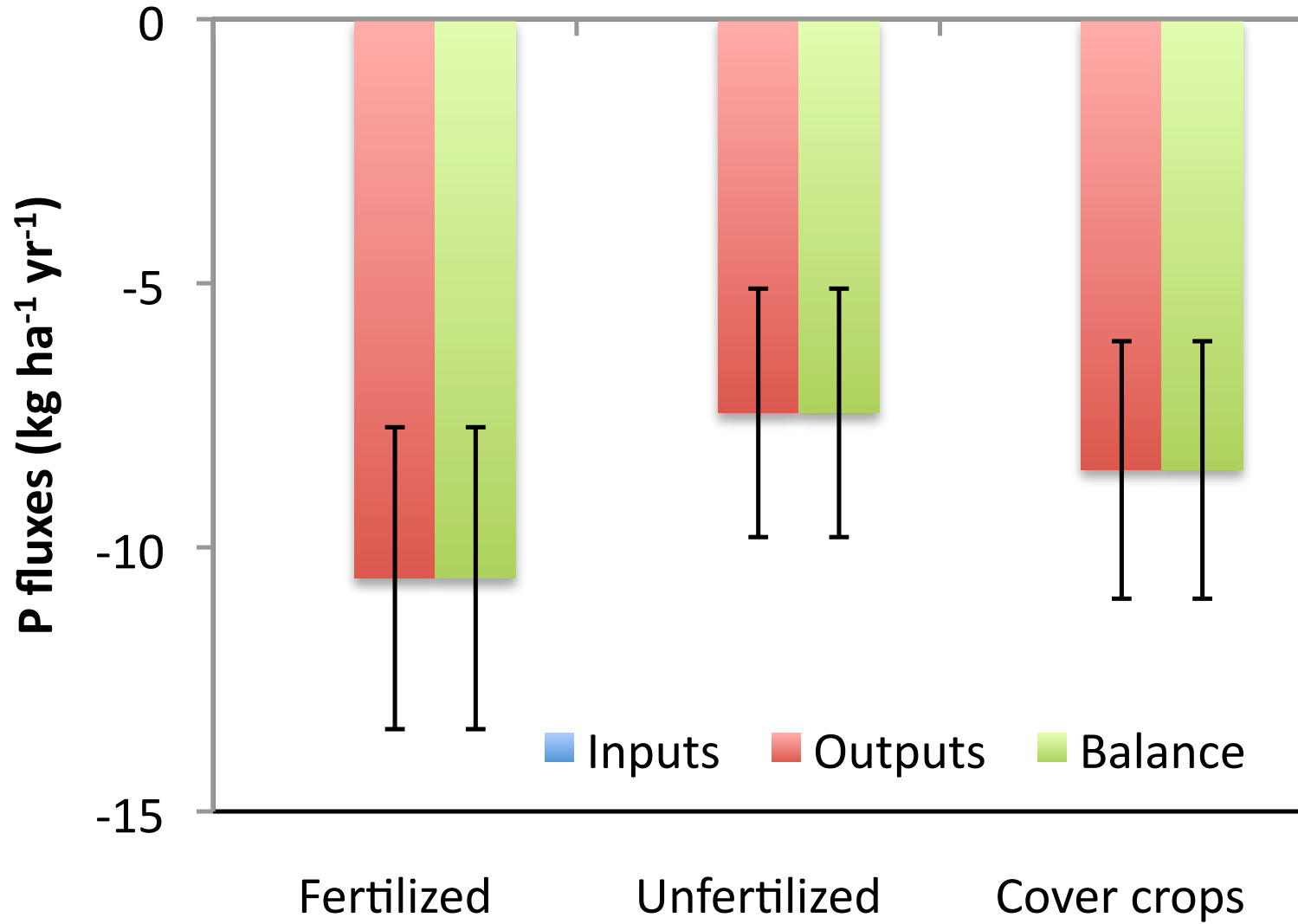
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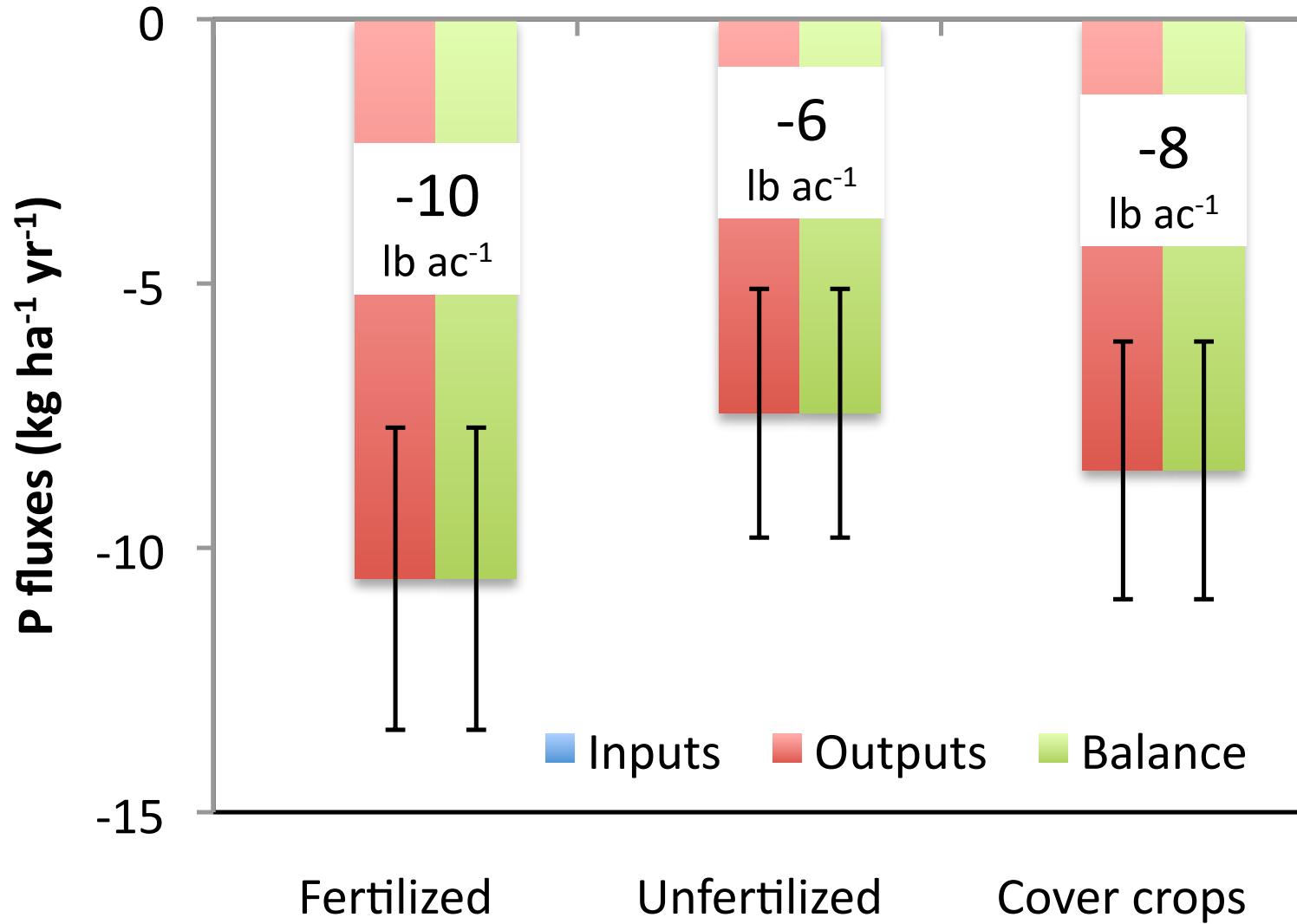


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Irrigated corn-tomatoes

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- Organic: 4-12 tons ac<sup>-1</sup> of manure at 1.37% P = 101 kg P ha<sup>-1</sup> = 90 lb ac<sup>-1</sup> yr<sup>-1</sup>
- Conventional: 50 kg P ha<sup>-1</sup> = 45 lb ac<sup>-1</sup> yr<sup>-1</sup>

# Inputs

- Organic: 4-12 tons  $\text{ac}^{-1}$  of manure at 1.37% P =  $101 \text{ kg P ha}^{-1} = \underline{\mathbf{90 \text{ lb ac}^{-1} \text{ yr}^{-1}}}$
- Conventional:  $50 \text{ kg P ha}^{-1} = \underline{\mathbf{45 \text{ lb ac}^{-1} \text{ yr}^{-1}}}$
- Mixed:  $50 \text{ kg P ha}^{-1}$  only before tomatoes =  $25 \text{ kg P ha}^{-1} = \underline{\mathbf{22.5 \text{ lb ac}^{-1} \text{ yr}^{-1}}}$

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- Corn
  - Yields: Conventional >> Organic  $\approx$  Mixed
  - %P: Similar across treatments



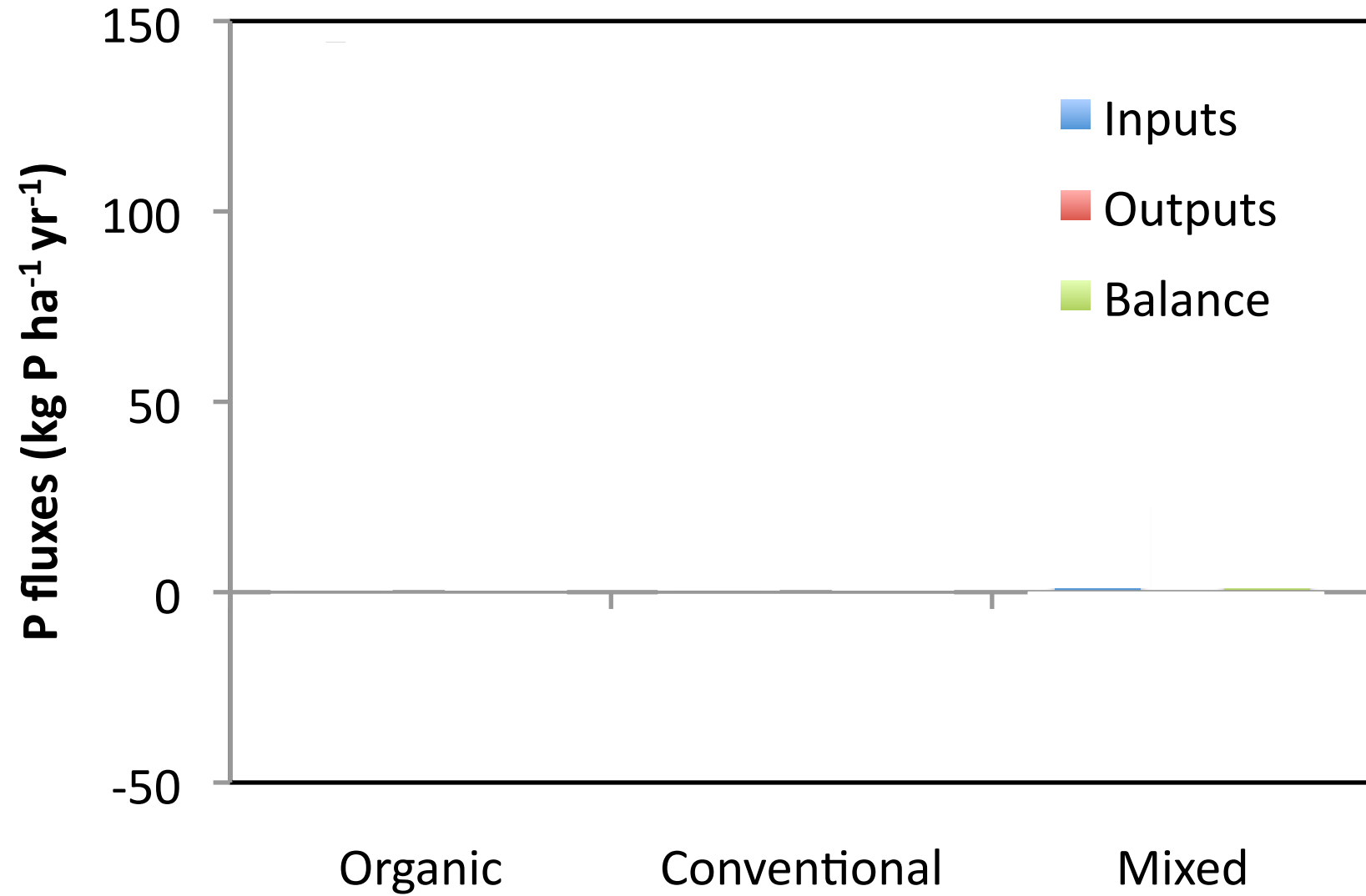
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- Corn
  - Yields: Conventional >> Organic  $\approx$  Mixed
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- Tomatoes
  - Yields: Similar across treatments
  - %P: Organic > Mixed  $\approx$  Conventional

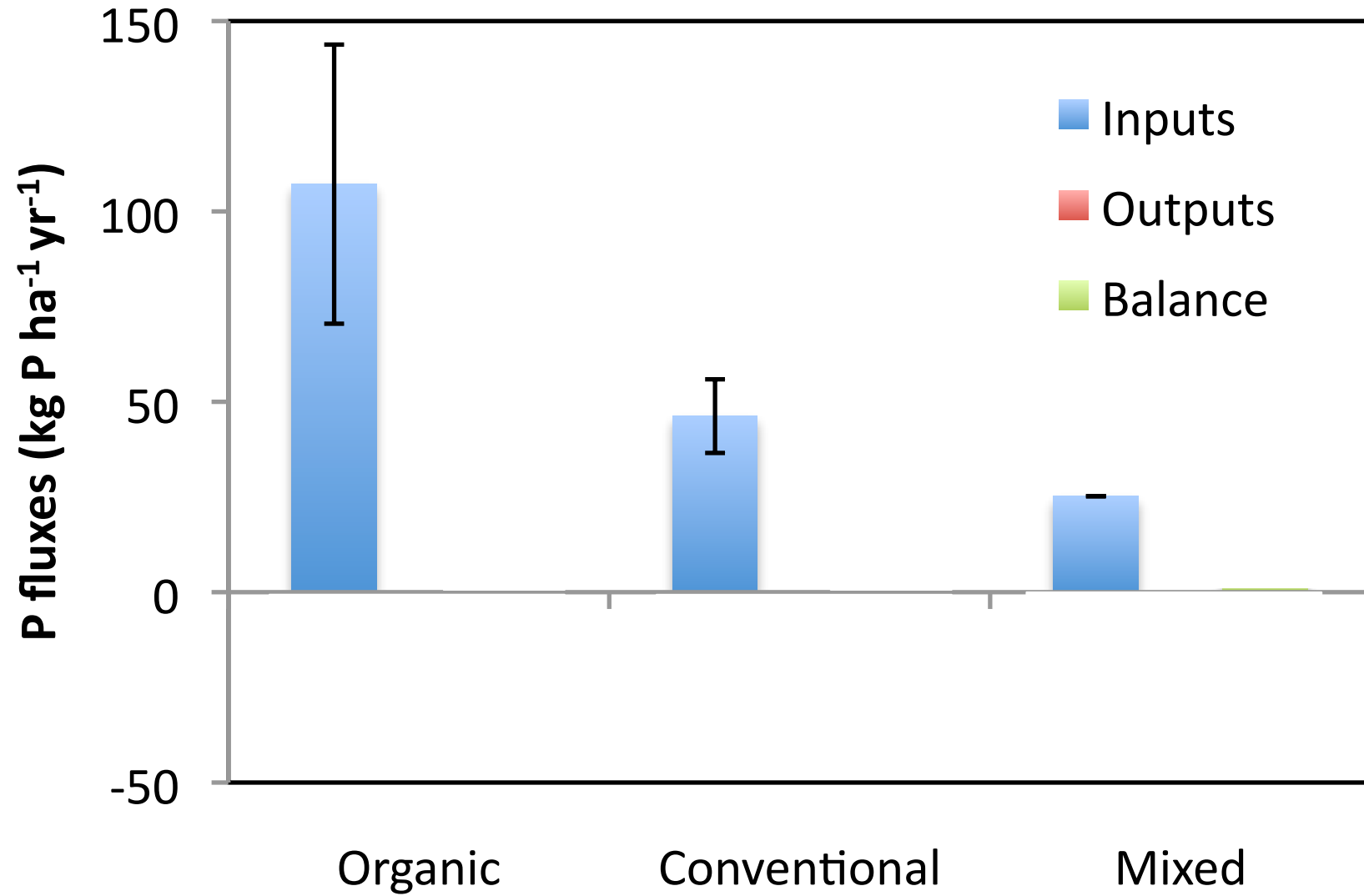
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- Corn
  - Yields: Conventional >> Organic  $\approx$  Mixed
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- Tomatoes
  - Yields: Similar across treatments
  - %P: Organic > Mixed  $\approx$  Conventional
- Wheat
  - Yields: Conventional  $\approx$  Mixed > Organic
  - %P: Not measured

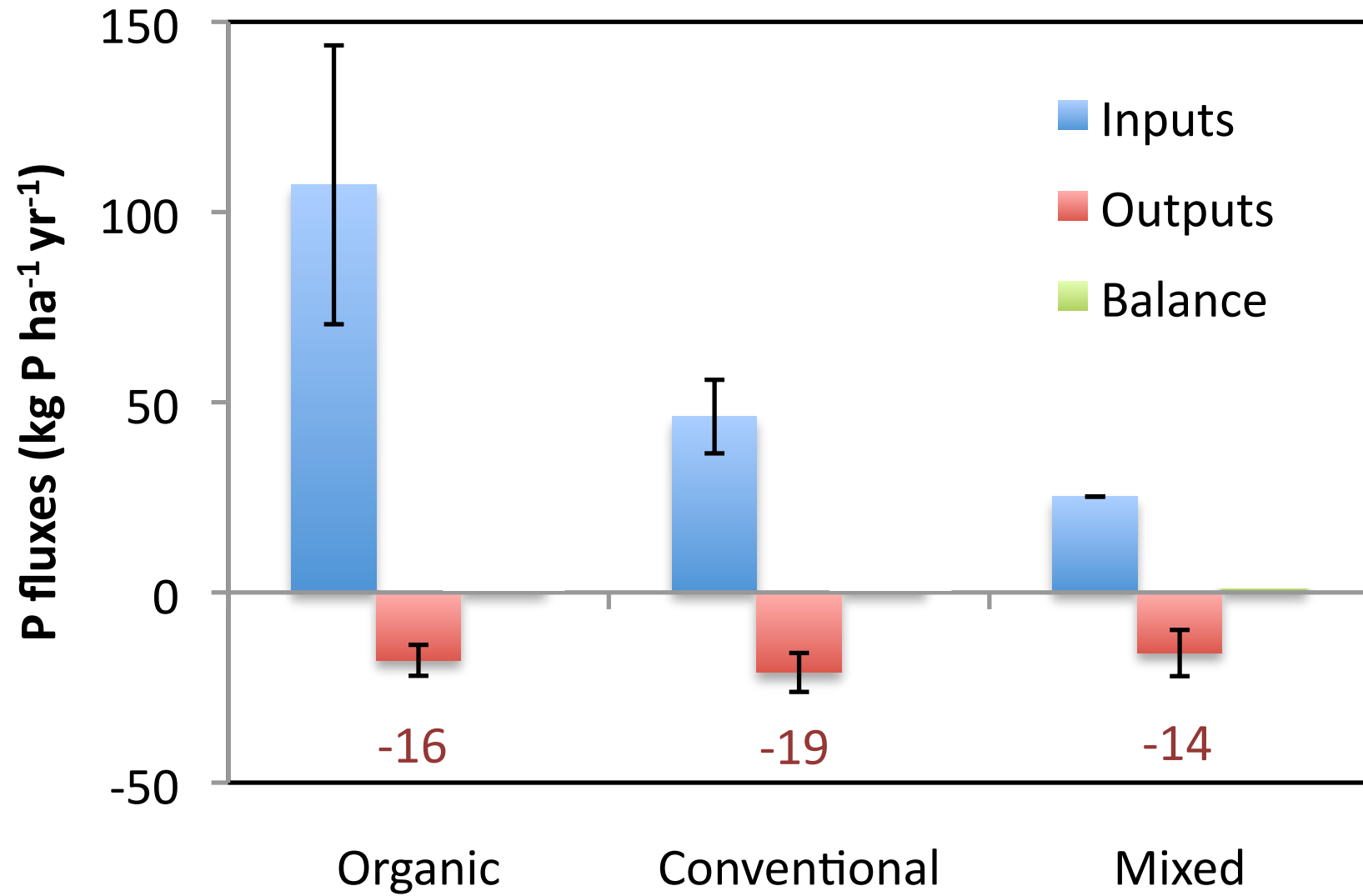
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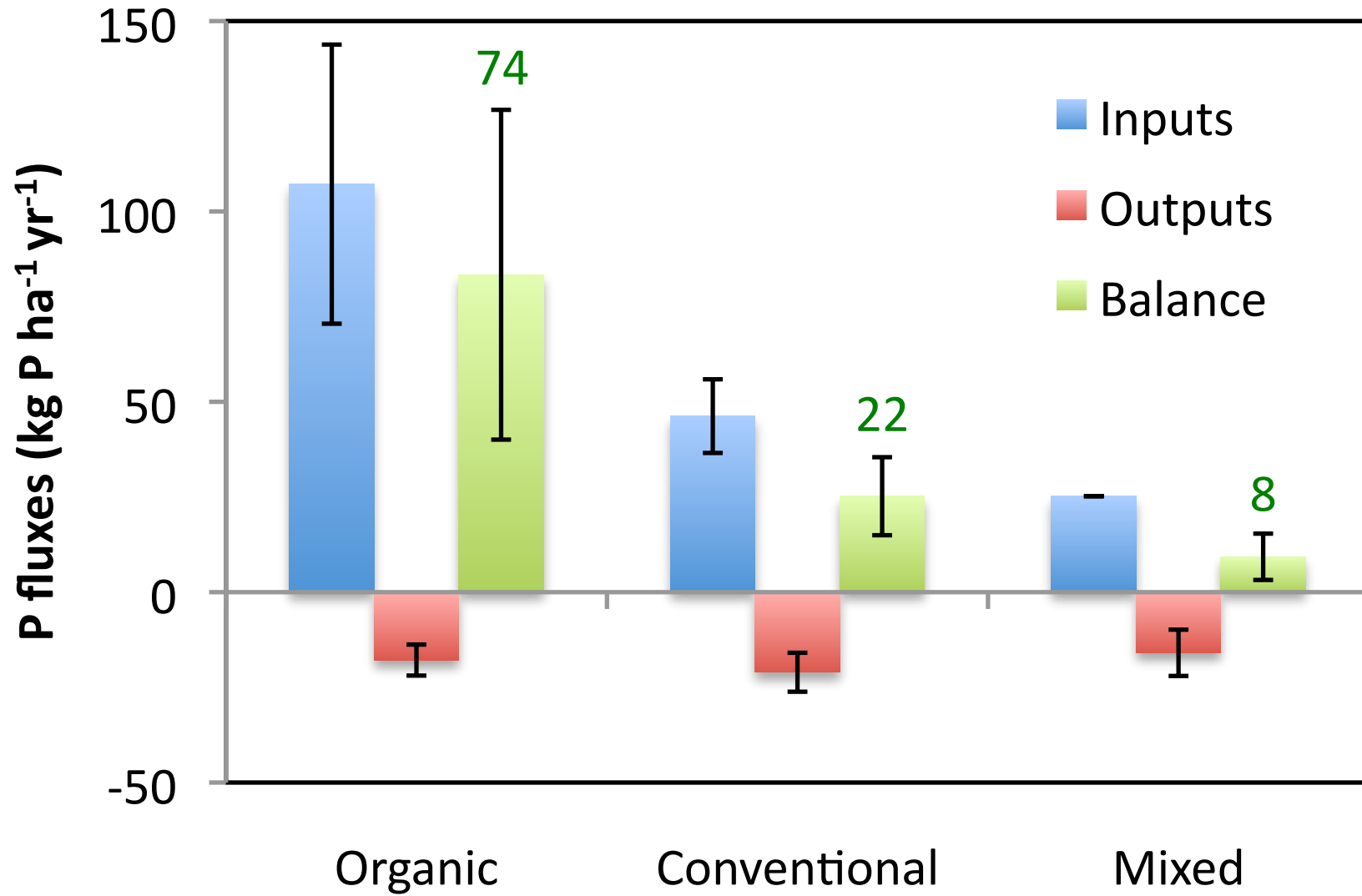
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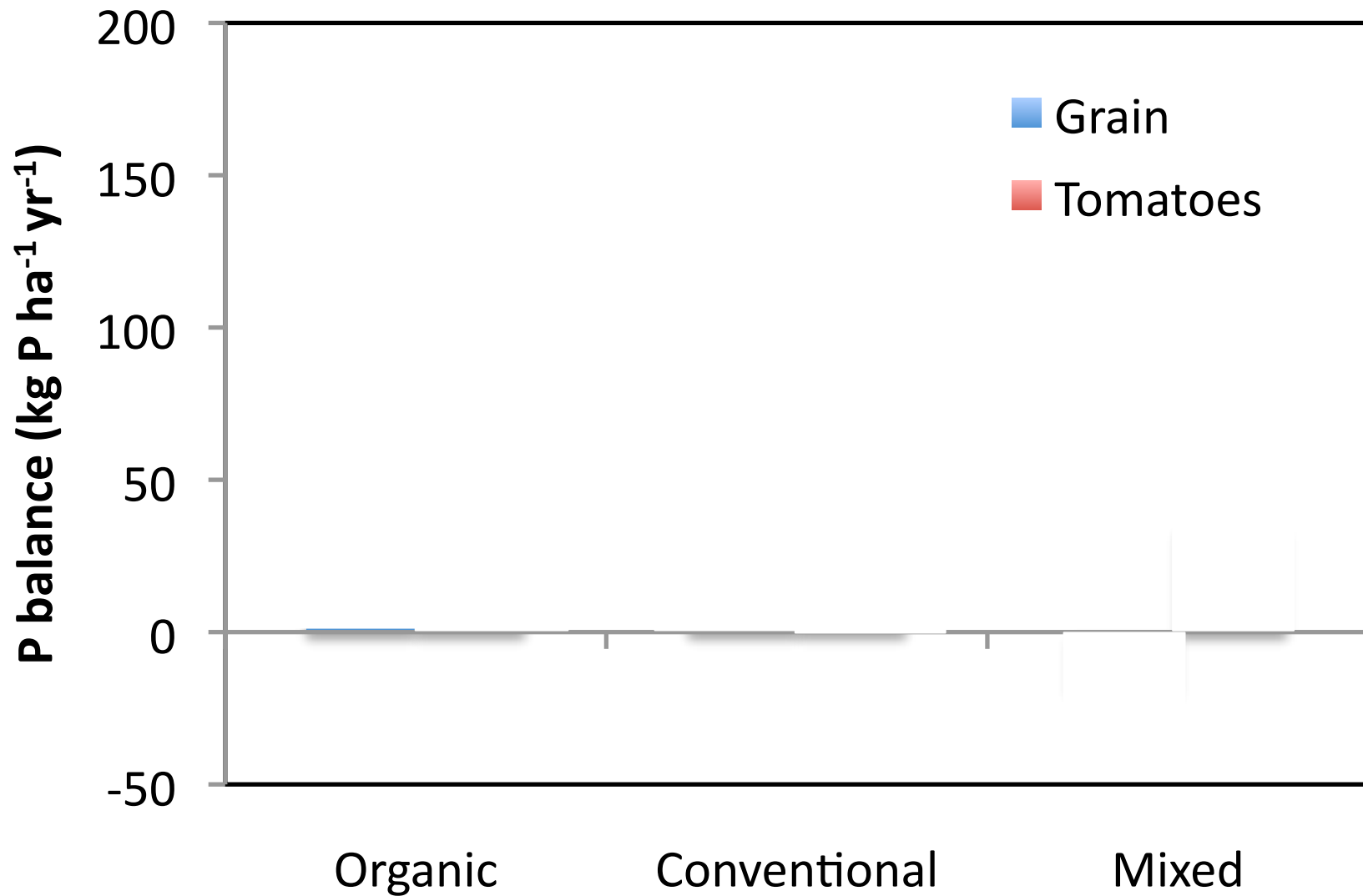
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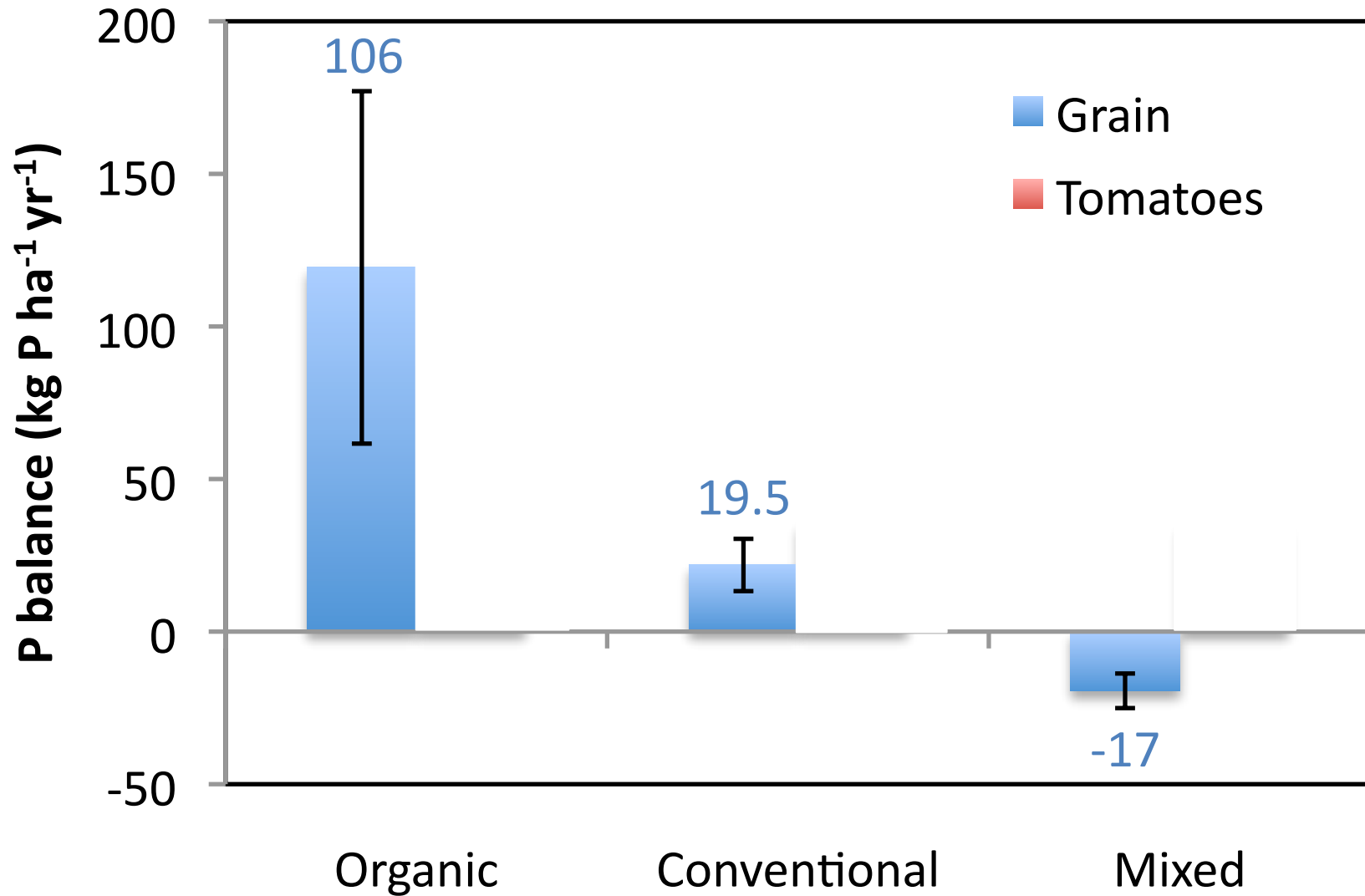
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# P budget – corn vs. tomato

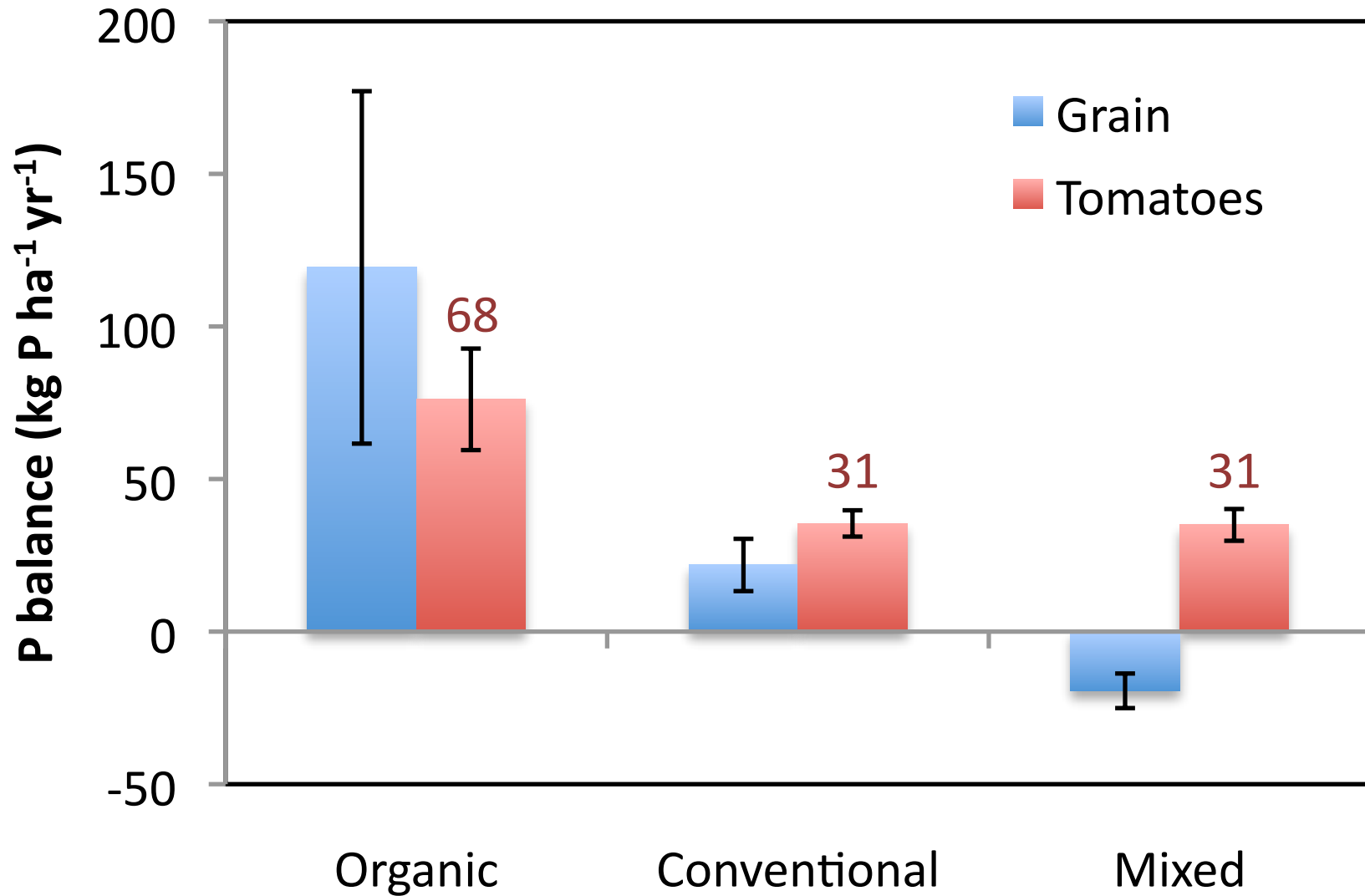


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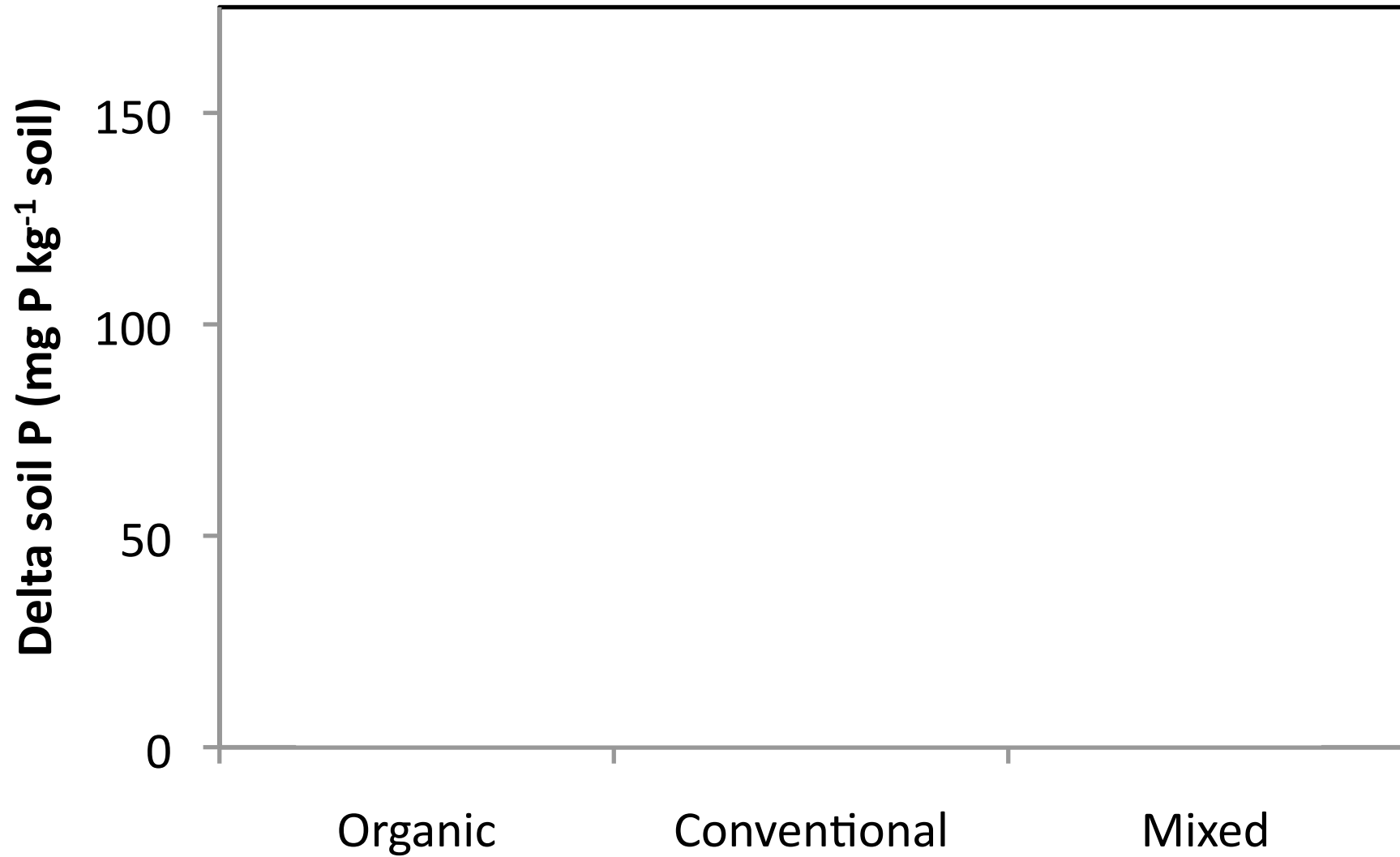




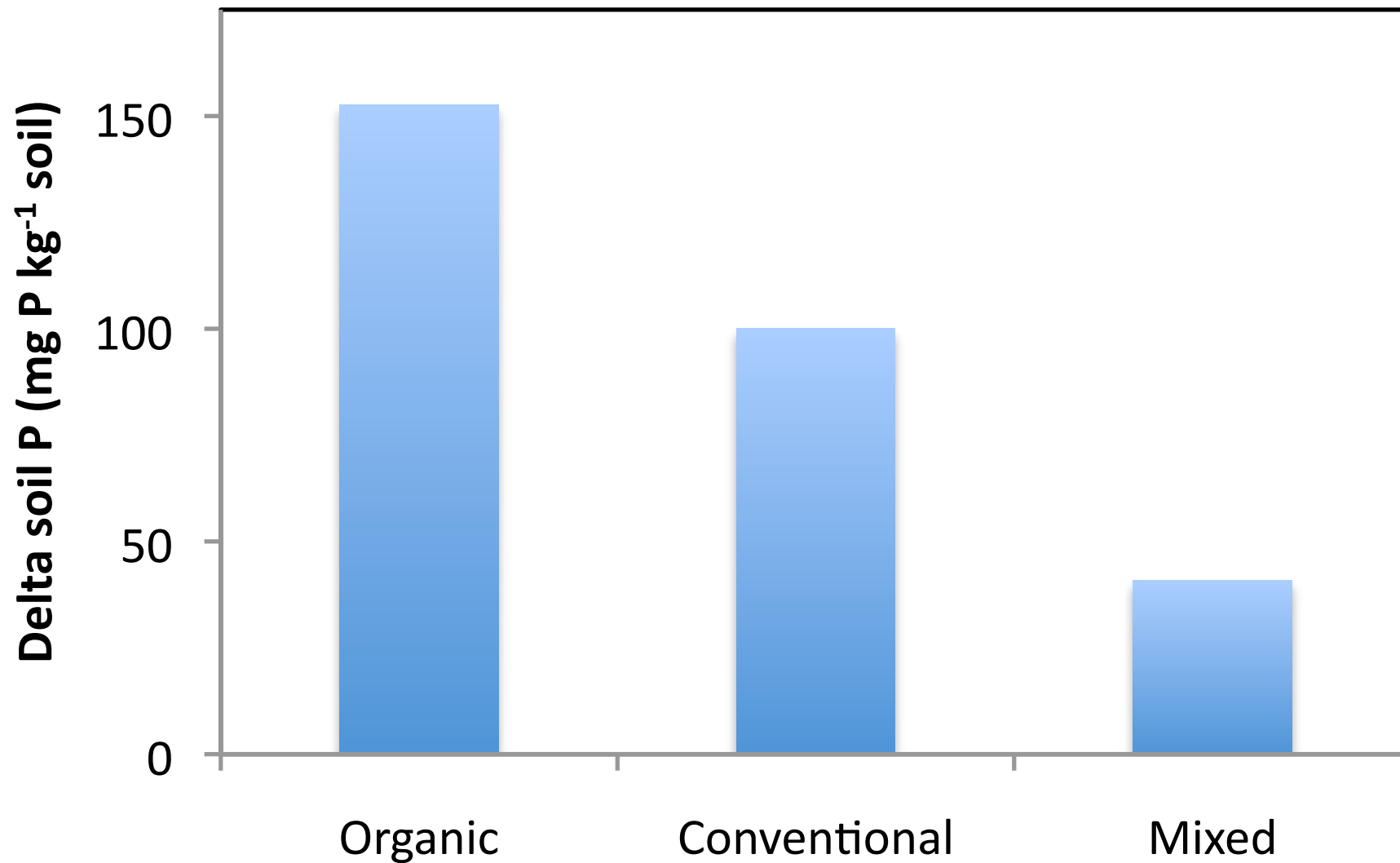
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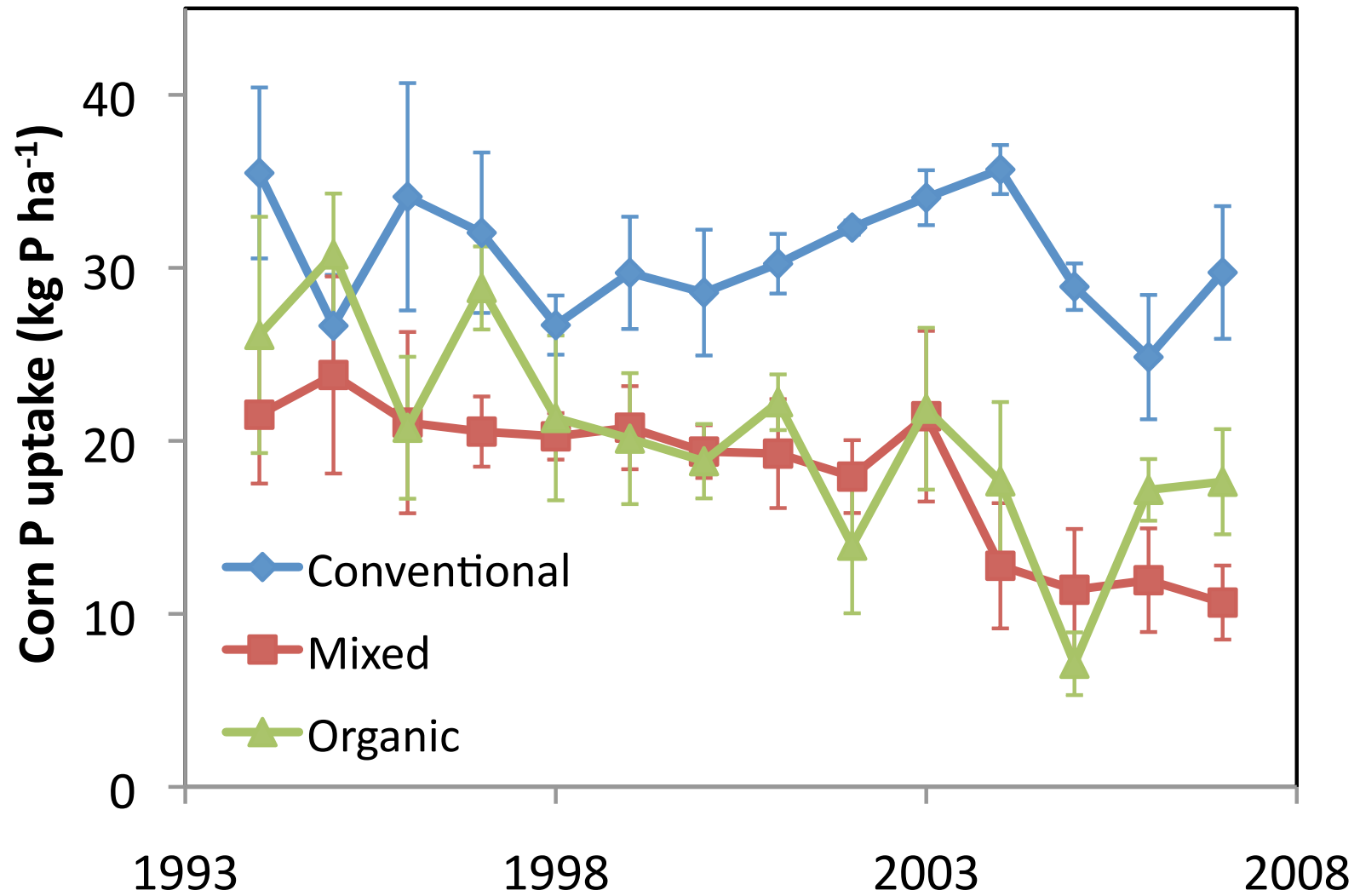
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- Irrigated rotations
  - Balance driven by inputs more than yields
  - Surpluses everywhere + highest in organic plots
  - Soil P accumulation lower than expected suggests losses may be important



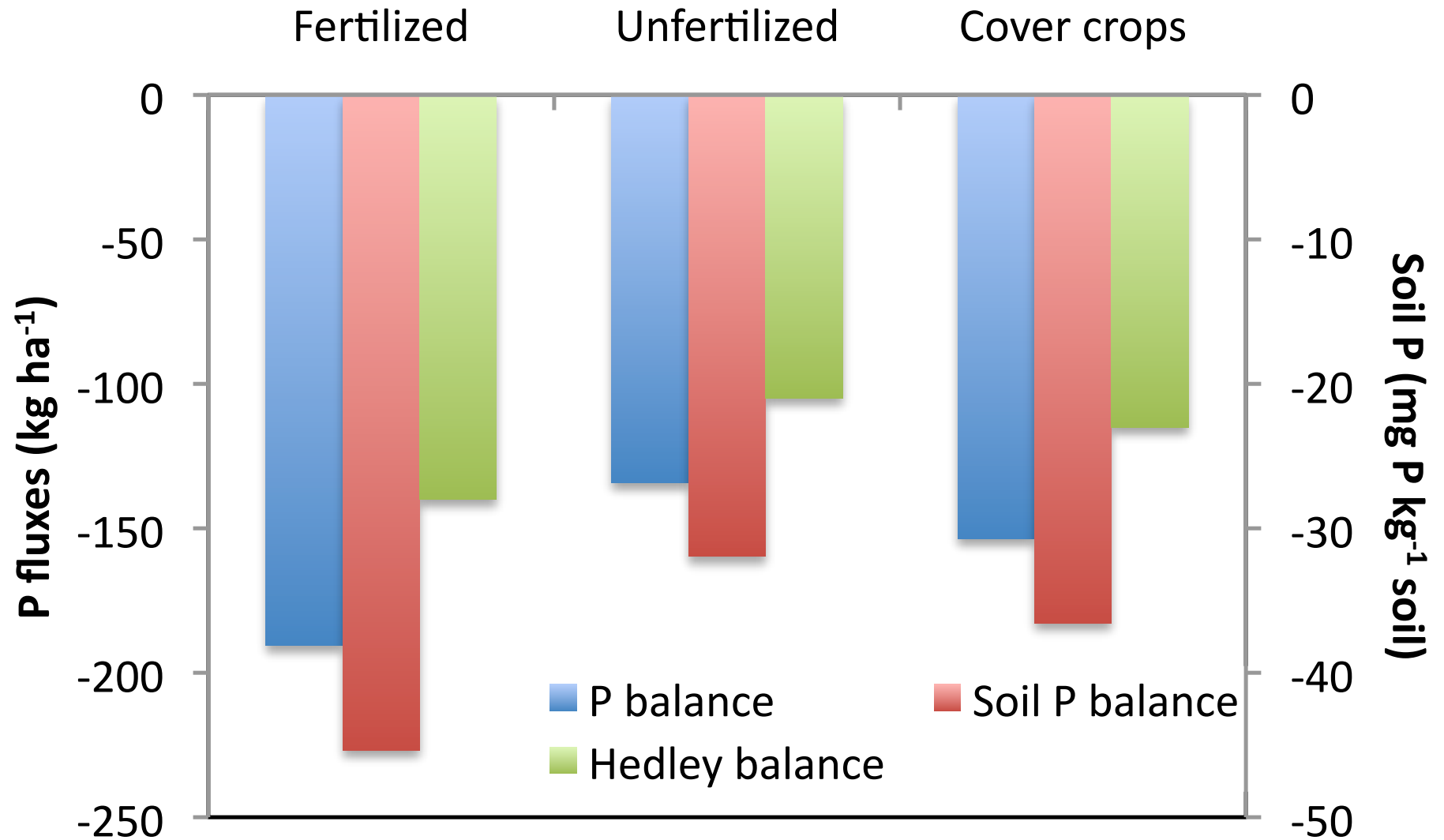
Questions/Comments

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# Example of inter-annual variation



# Cumulative balance vs. soil P



# Soil profile of P

Olsen P ( $\mu\text{g P g}^{-1}$  soil)

