Greenhouse gas emissions from arable and vegetable cropping systems

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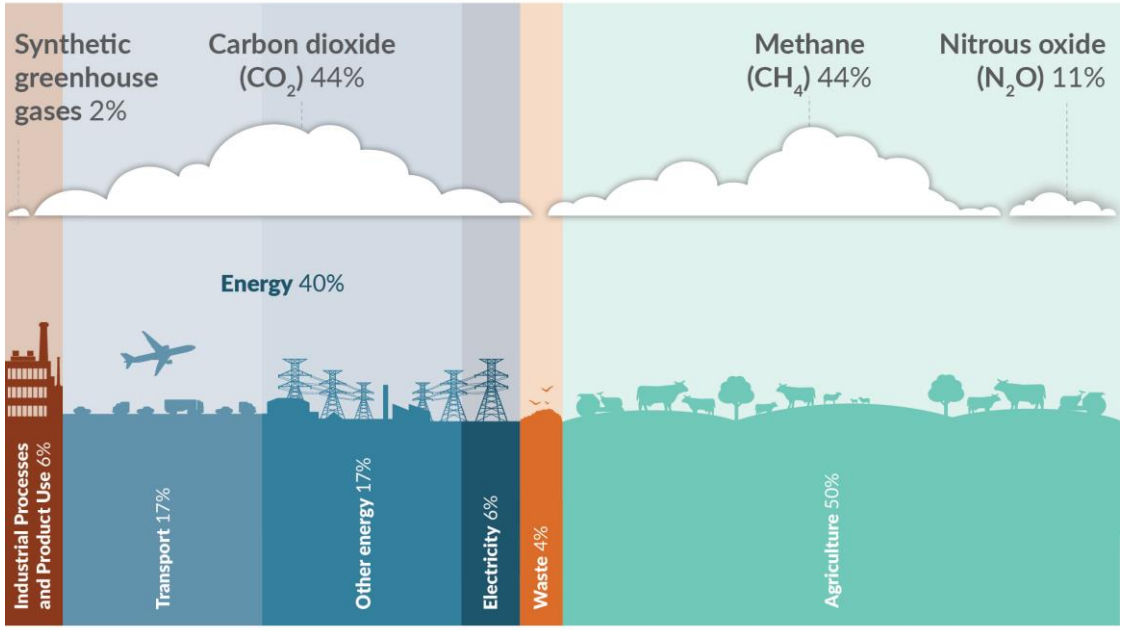
Background

- NZ
  - Agriculture contributes 50% of NZ total emissions
  - Agricultural emission reduction targets (CH_4)
  - Agricultural emission pricing – 2025

- Cropping
  - Lack of research on emissions in NZ
  - Lack of quantification through crop rotations
  - Lack of mitigation advice

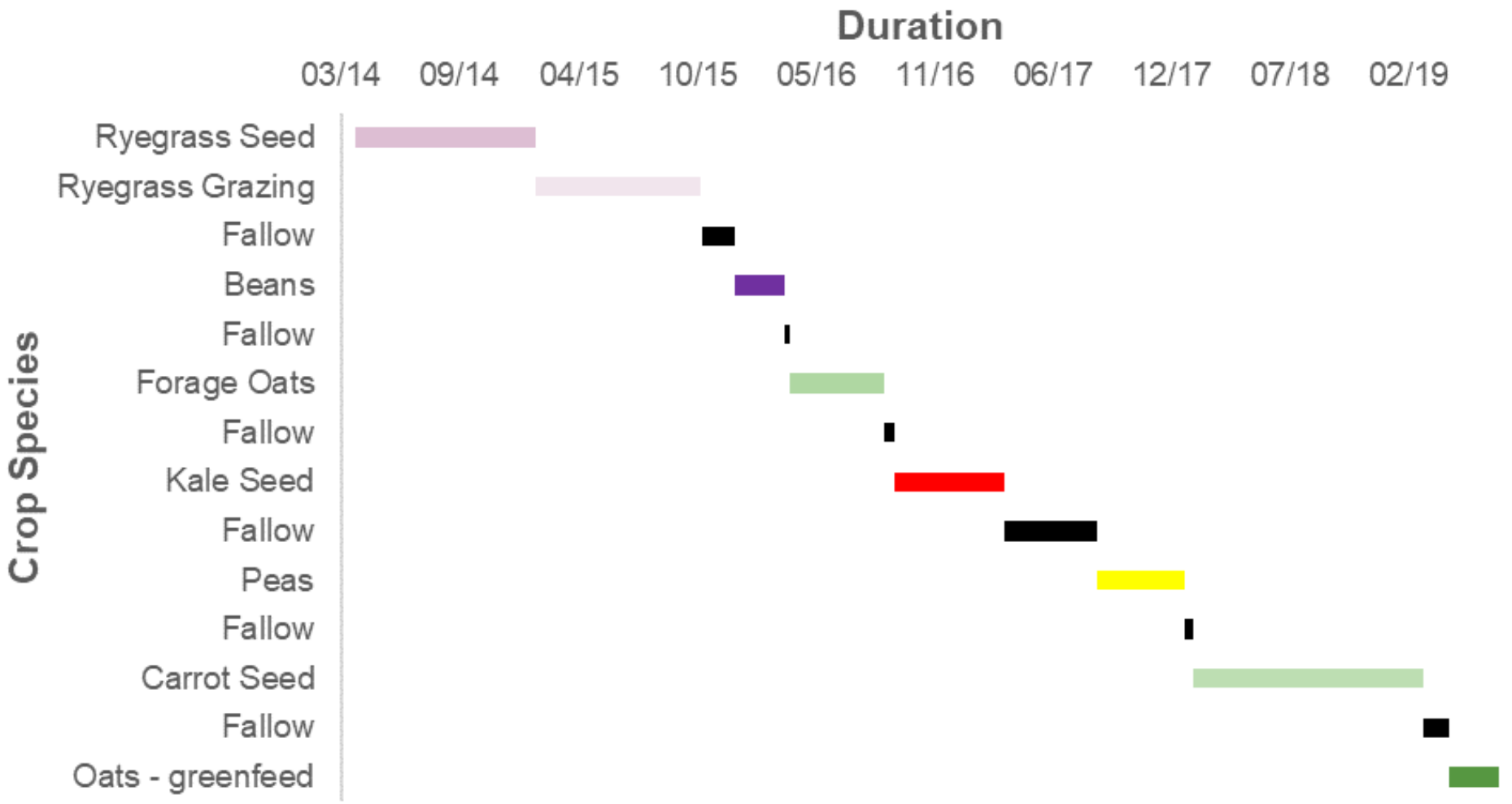


GHG emissions from arable and vegetable rotations

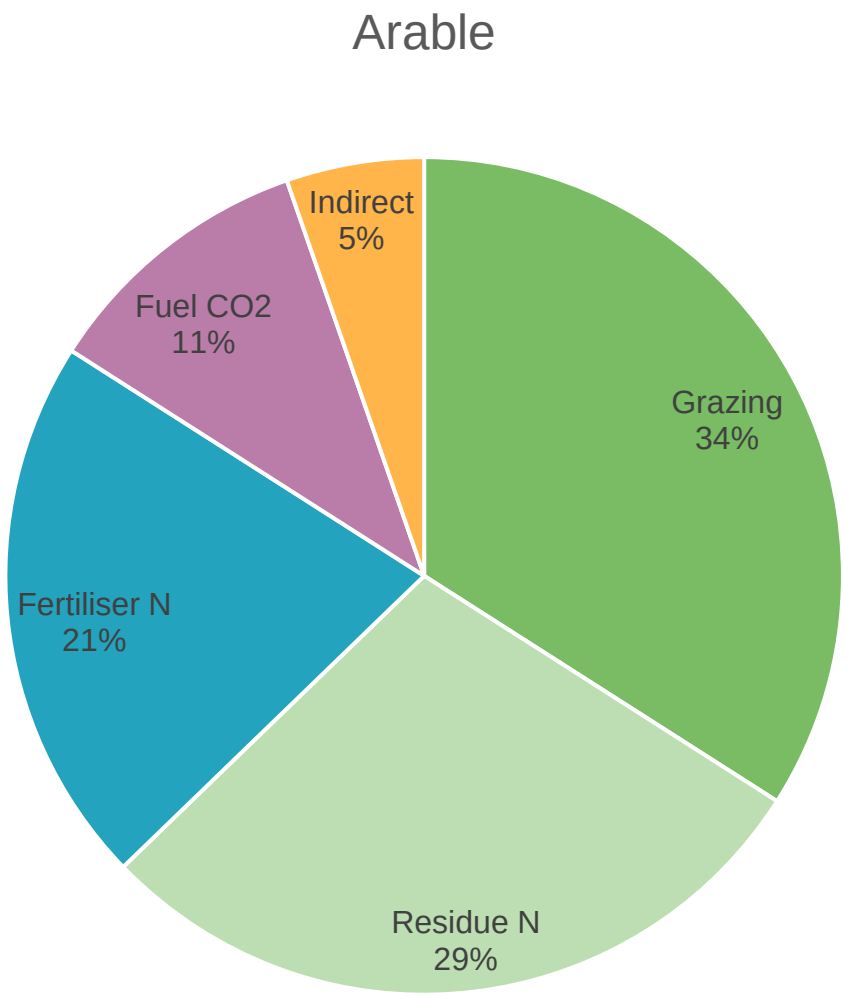
- Background to the studies:
  - Lack of industry knowledge
    - Where do we fit?
    - What are the key emitters?
    - What are the key levers?
    - He Waka Eke Noa
  - Effect of rotations
  - Lack of NZ relevant research

- Method
  - Inventory approach - emission budget
  - Within the farm gate

Arable rotation

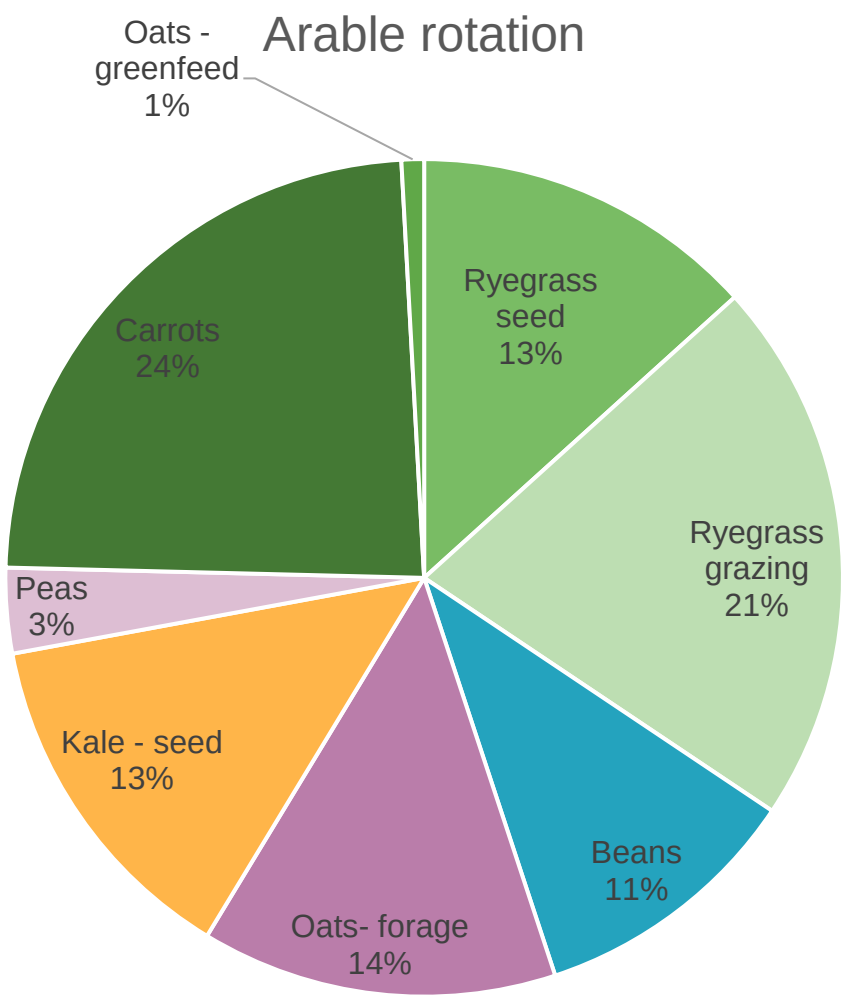


Key sources of GHG emissions from an arable rotation



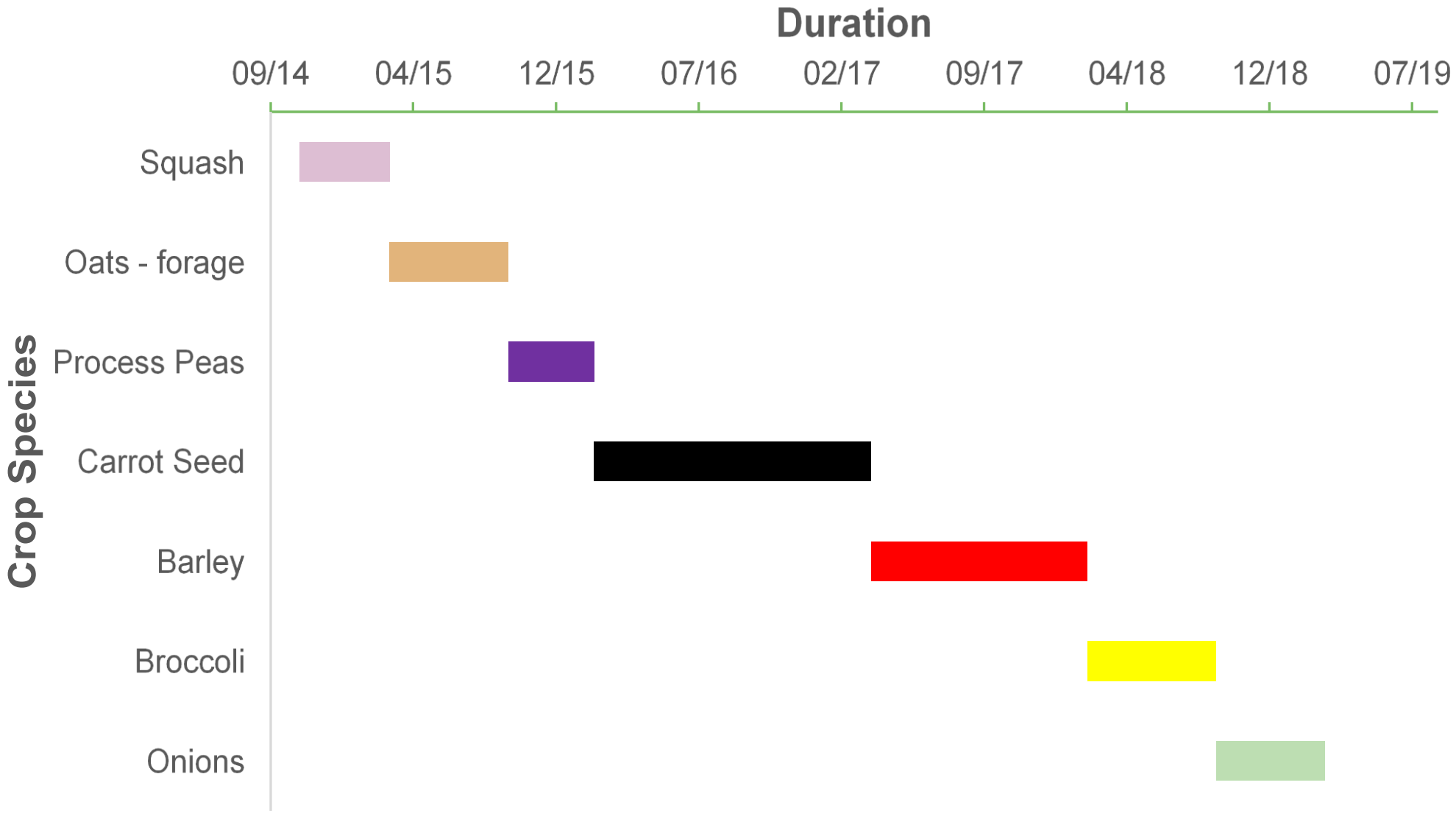
Activity	Gas	Arable (%)
Grazing	CH_4 N_2O	30 2
Residue N	N_2O	27
Fertiliser N	N_2O	20
Indirect N	N_2O	5
Fuel	CO_2	10
Irrigation	CO_2	6

Contributions of different arable crops to overall emissions

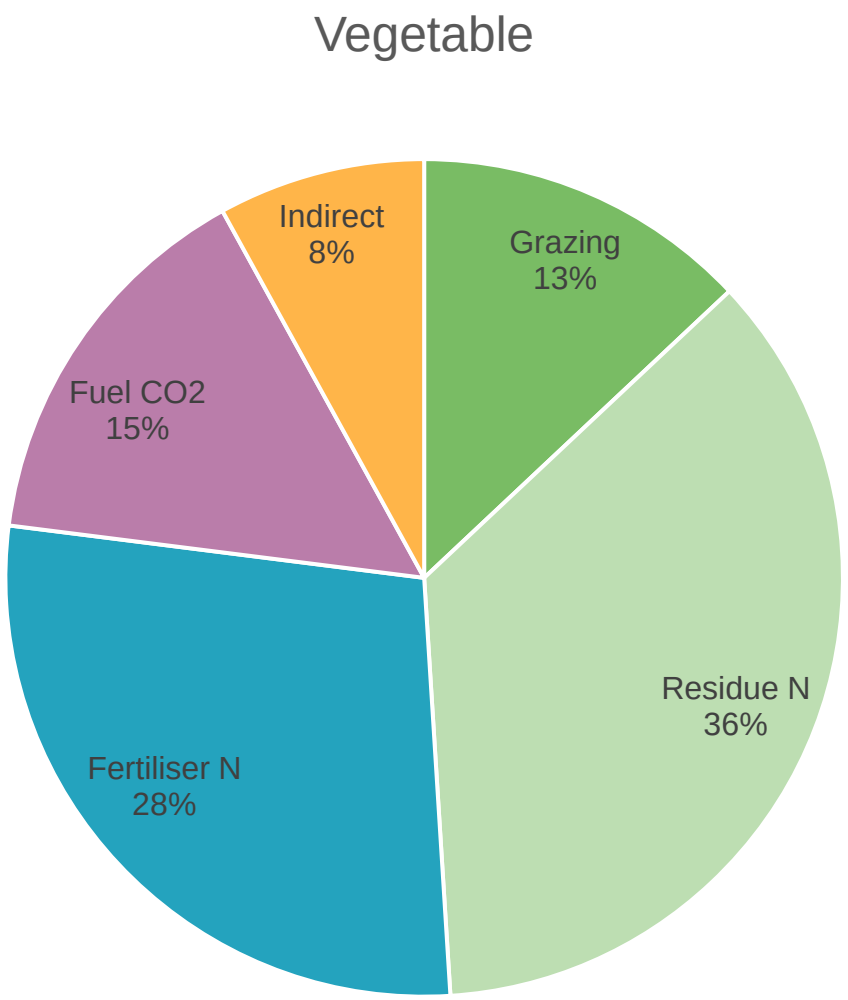


Crop	Source 1	Source 2
Ryegrass seed	Fertiliser	Grazing
Ryegrass grazing	Grazing	
Beans	Fertiliser	Residue
Oats- forage	Grazing	
Kale - seed	Residue	Fertiliser
Peas	Fuel	Residue
Carrots	Residue	Fertiliser
Oats - greenfeed	Grazing	Fertiliser

Vegetable rotation

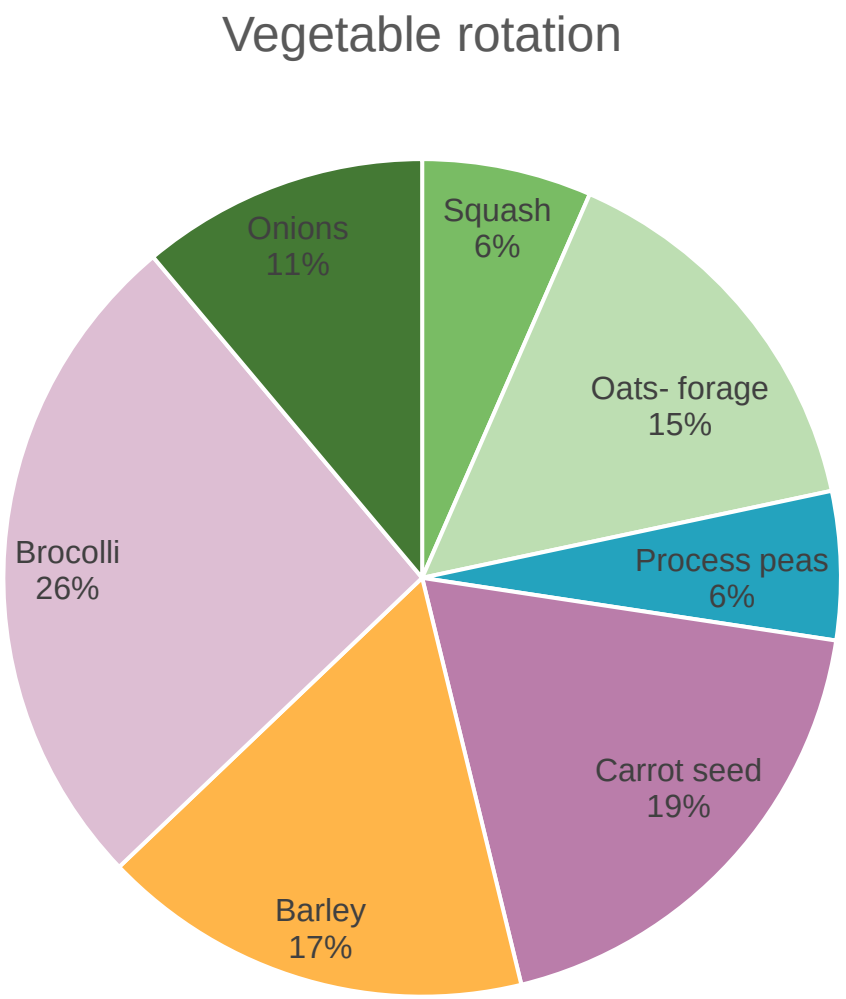


Key sources of GHG emissions from a vegetable rotation



Activity	Gas	Vegetable (%)
Grazing	CH_4 N_2O	12 1
Residue N	N_2O	36
Fertiliser N	N_2O	28
Indirect N	N_2O	8
Fuel	CO_2	15

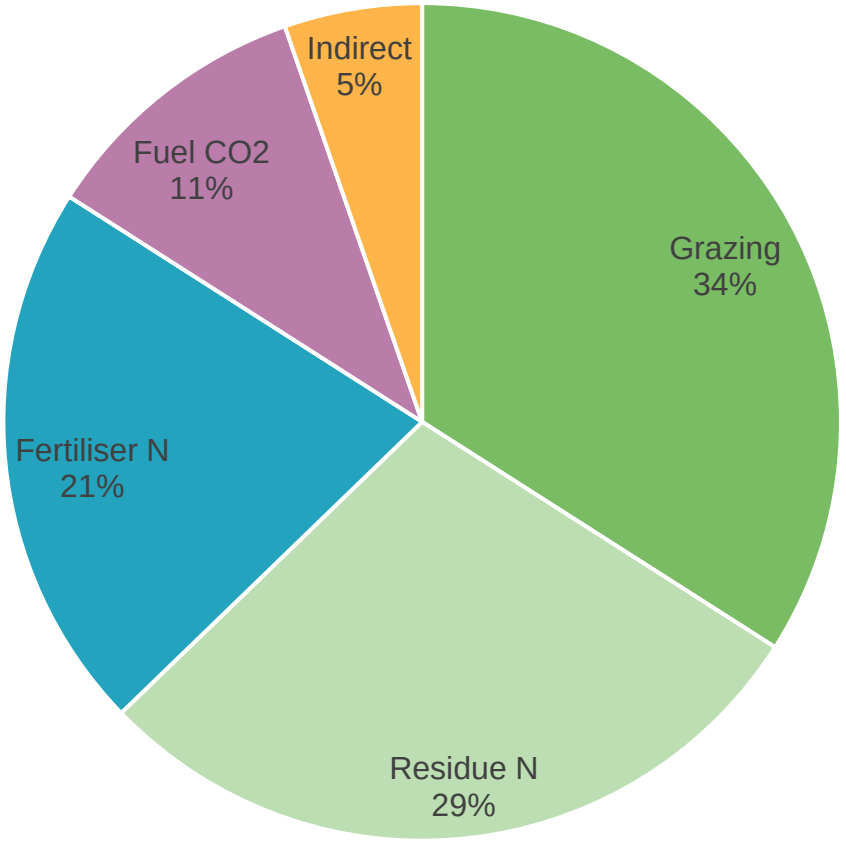
Contributions of different vegetable crops to overall emissions



Crop	Source 1	Source 2
Squash	Residue	Fertiliser
Oats- forage	Grazing	
Process peas	Residue	
Carrot seed	Residue	Fertiliser
Barley	Fertiliser	Residue
Brocolli	Residue	Fertiliser
Onions	Fertiliser	

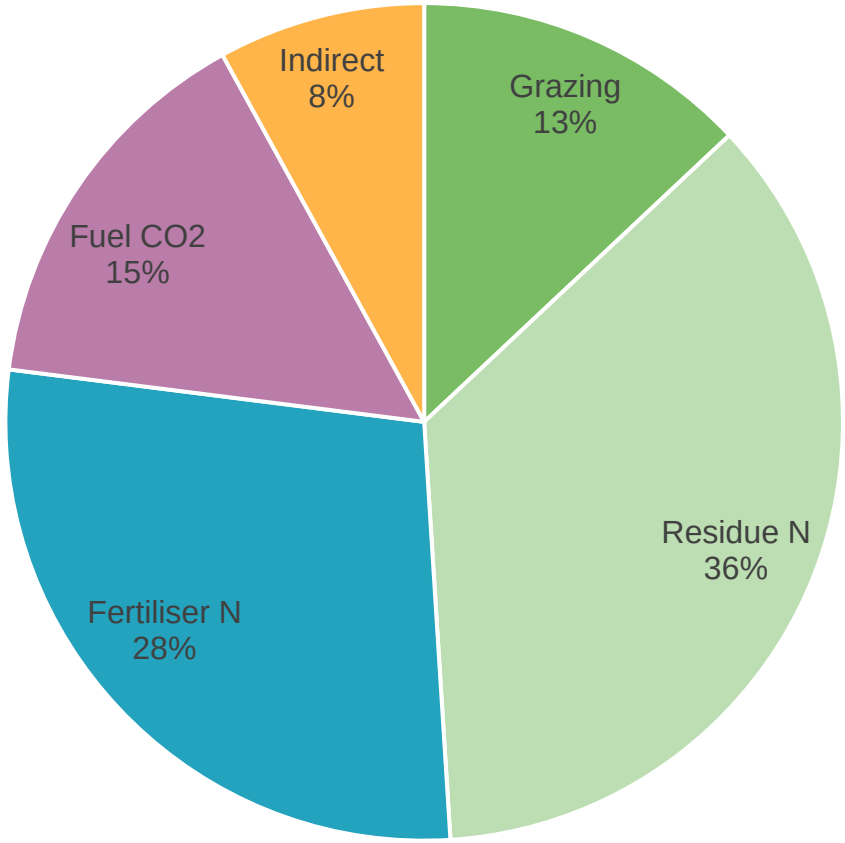
Summary of key sources of GHG emissions in an arable and vegetable rotation

Arable



1962 kg CO_2-e /ha/year

Vegetable



1983 kg CO_2-e /ha/year

Is this information useful to farmers?

- Pros
  - Simple
  - Identifies big management drivers
  - Easy to look at all gases
  - Consistent with inventory
    - Uses NZ specific factors
  - Allows comparison between different crops and systems
  - Aligns with He Waka Eke Noa accounting

- Cons
  - Most crops are not accounted for in the inventory. Information on residues is lacking especially
  - Ignores key soil and climate drivers (N_2O)
    - Drainage
    - Aeration
    - pH
    - Rainfall
  - Ignores specific management effects
    - Machinery/animal traffic
    - Irrigation
    - N surpluses
    - Fallow periods
  - Does not account for changes in soil C
  - Difficult to design mitigations beyond high level drivers –ie. fertiliser and residues
  - Offsite emissions of residues? Who is responsible?

Acknowledgements

- Foundation for Arable Research (FAR)
- Vegetable Research and Innovation Board (VR&I)
- Steve Dellow, Jo Sharp
- Dirk Wallace, Abie Horrocks

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Rangahau Ahumāra Kai

Thank you

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