Nordic-Baltic Field Trials Validating the New Dual-Use Perennial Grain Crop Kernza (Viking)

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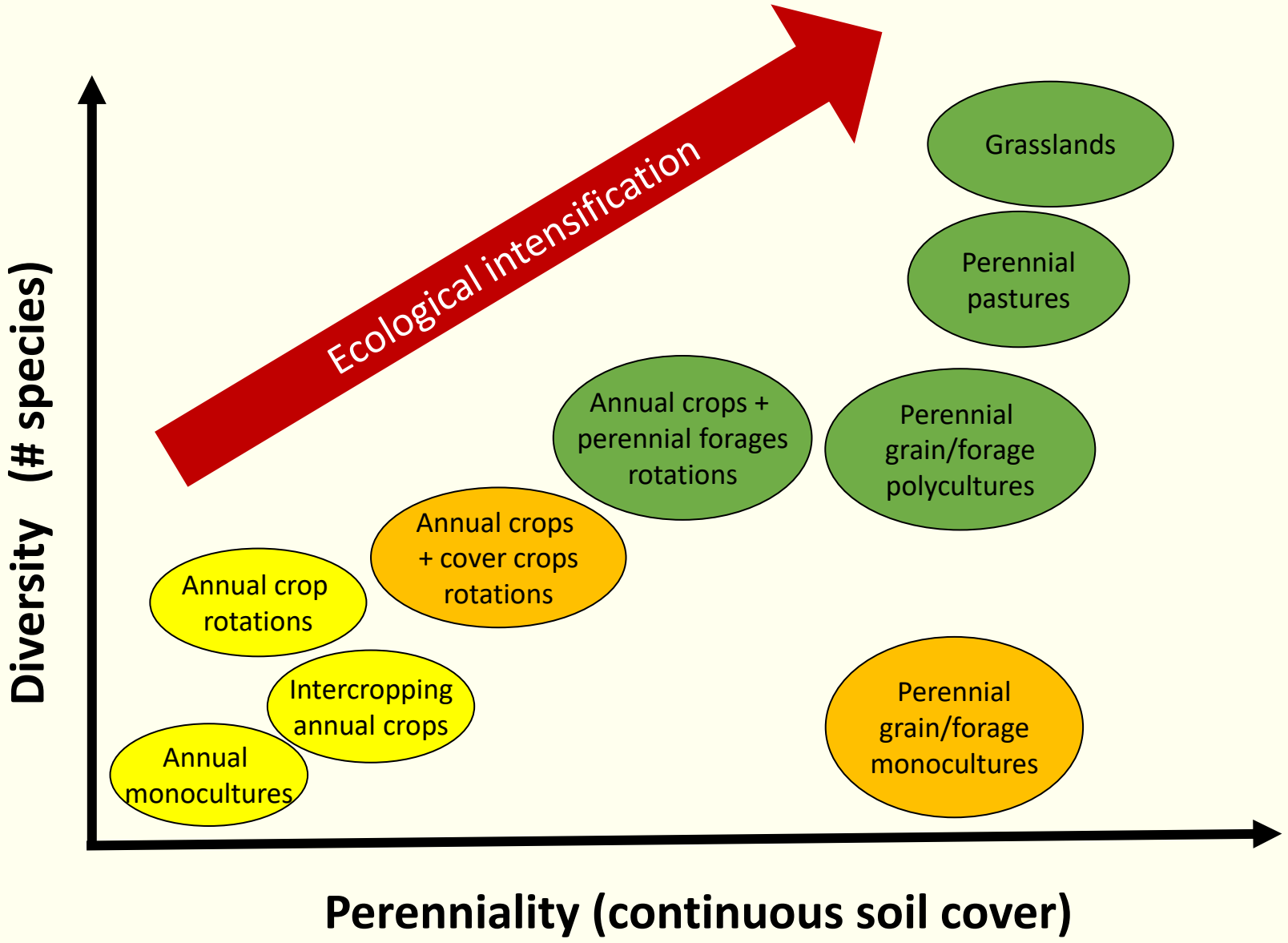
and the VIKING Team

Agroecosystem structural properties

Number of species over time (crop rotation) or space (intercropping)

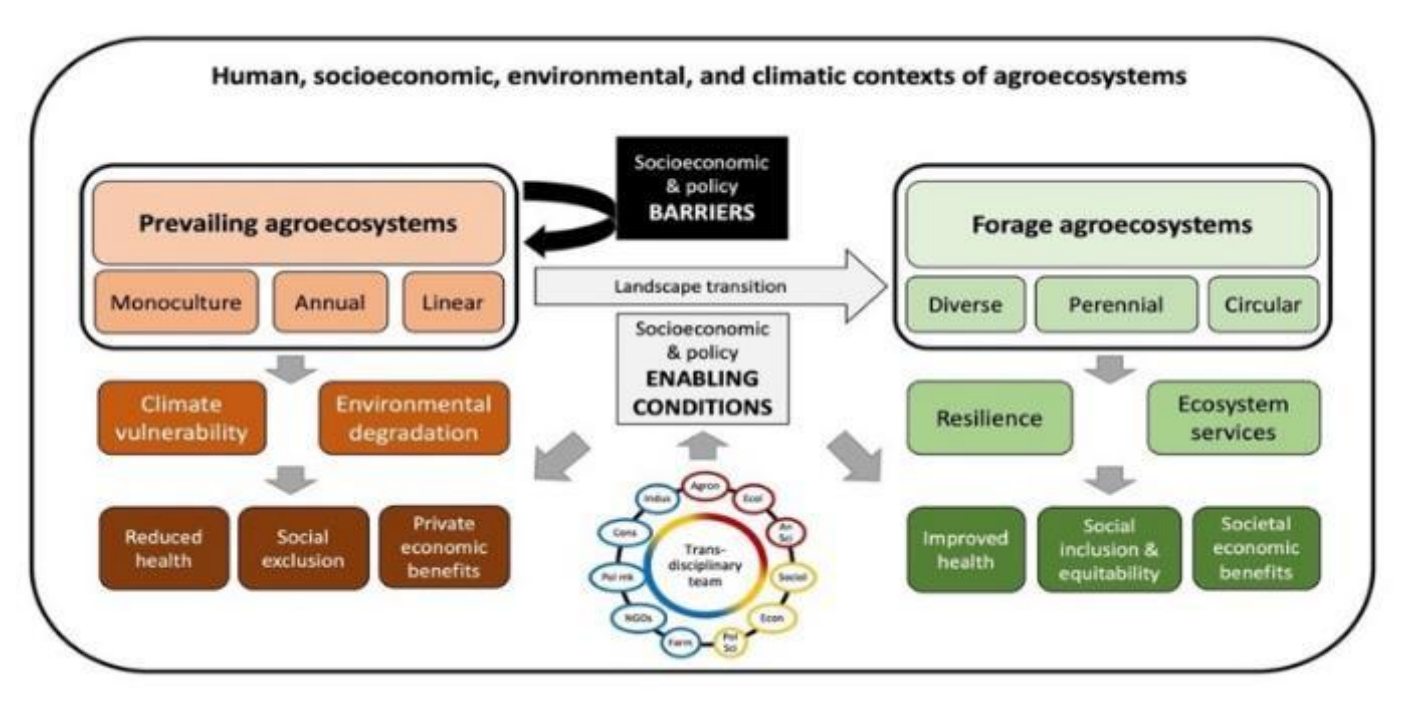


Franco, et al. (2021)

Perennial crops

- Ecosystem services:
  - Soil erosion control
  - Nutrient leaching reduction
  - Carbon balance
  - Biodiversity habitat
- Multiple agricultural uses:
  - Pastures for grazing
  - Forages for feed
  - Biomass for energy
  - Perennial grains

Diverse perennial circular forage systems are needed to foster resilience, ecosystem services, and socioeconomic benefits in agricultural landscapes



RESILIENCE CAP (USDA-SAS) 10 million US$

Picasso et al. (2022)

The perennial grain revolutionary idea

- Natural prairies (grasslands) as model
  - Perennial species
  - Diverse polycultures (intercropping)
- Perennial GRAINS
- Several crop species:
  - rice
  - wheat
  - sorghum
  - sunflower
  - barley
  - sainfoin
  - pigeon pea

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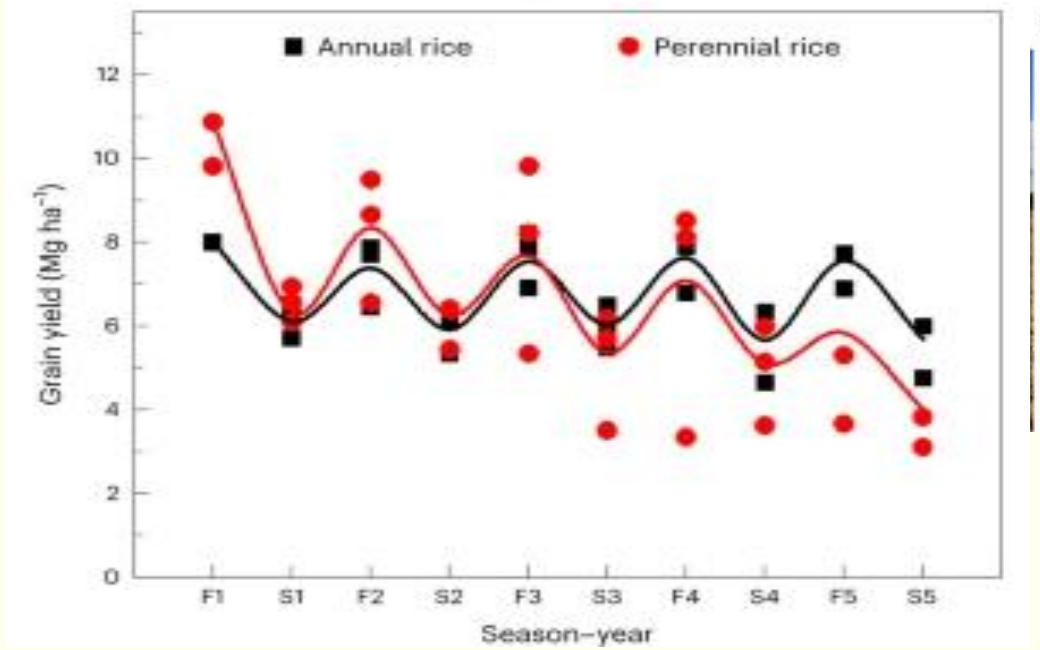
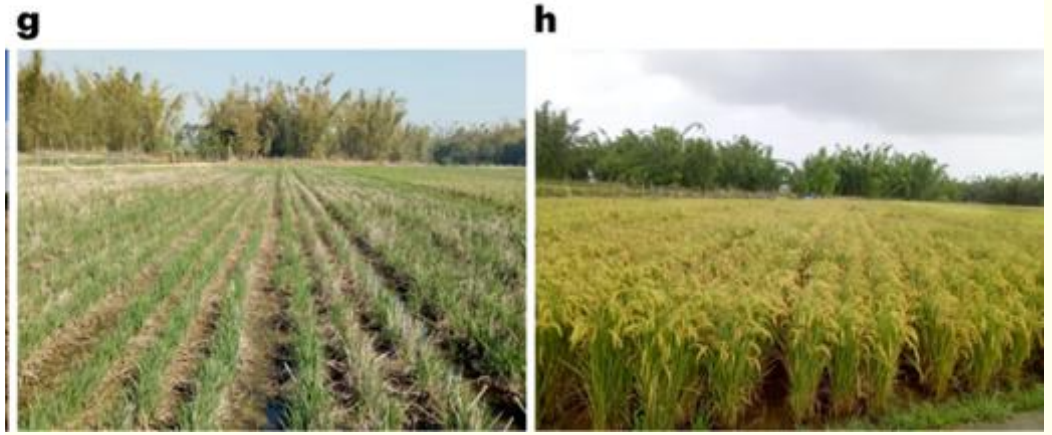
The success of perennial rice in Asia

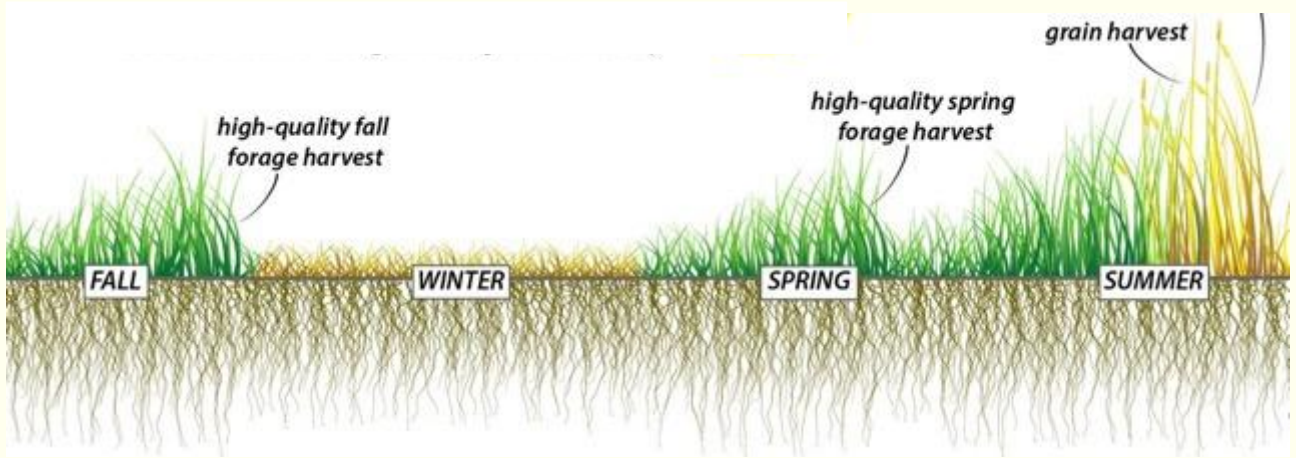




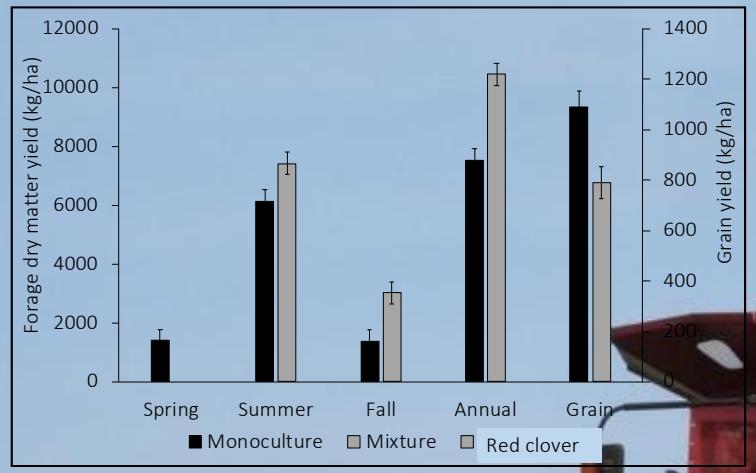
Zhang et al. (2022)
Nature Sustainability

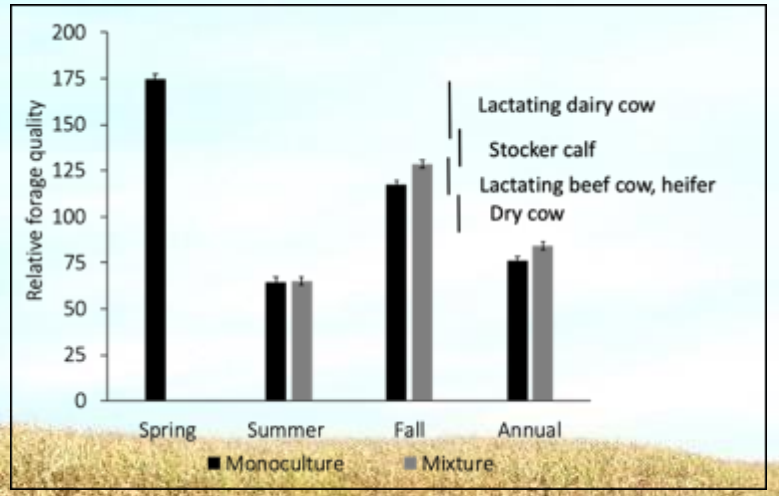
Intermediate wheatgrass Kernza® perennial grain

- Native grass from Europé
- Forage crop in western US
- Breeding for high grain yield (TLI-KS, UMN, UM, SLU, UY, UK, …)
- Deep rooted perennial
- Demand from food sector
- Dual-use: forage and grain



Kernza grain harvest in summer and cattle grazing in fall





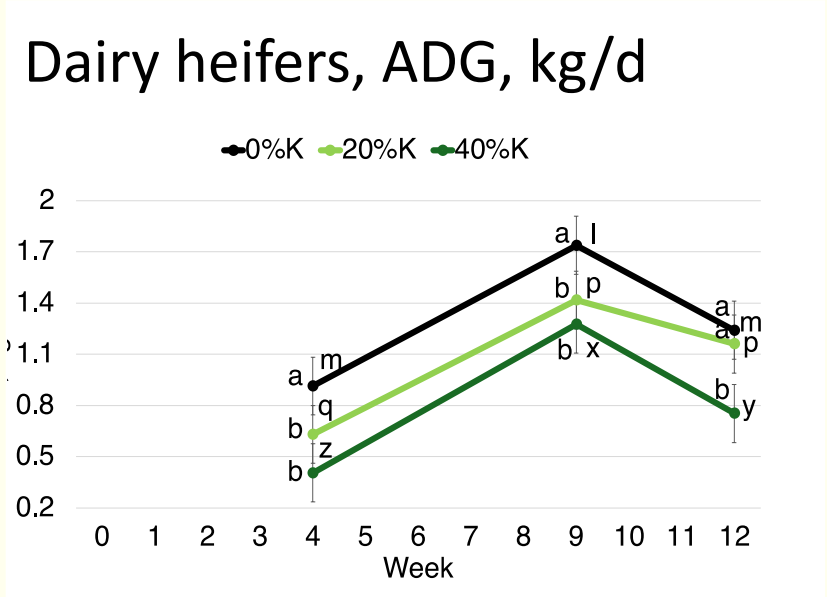
Favre et al. (2019)

Forage harvest management impacts "Kernza" intermediate wheatgrass productivity across North America

Culman et al. (2023)

Kernza forage value for livestock diets

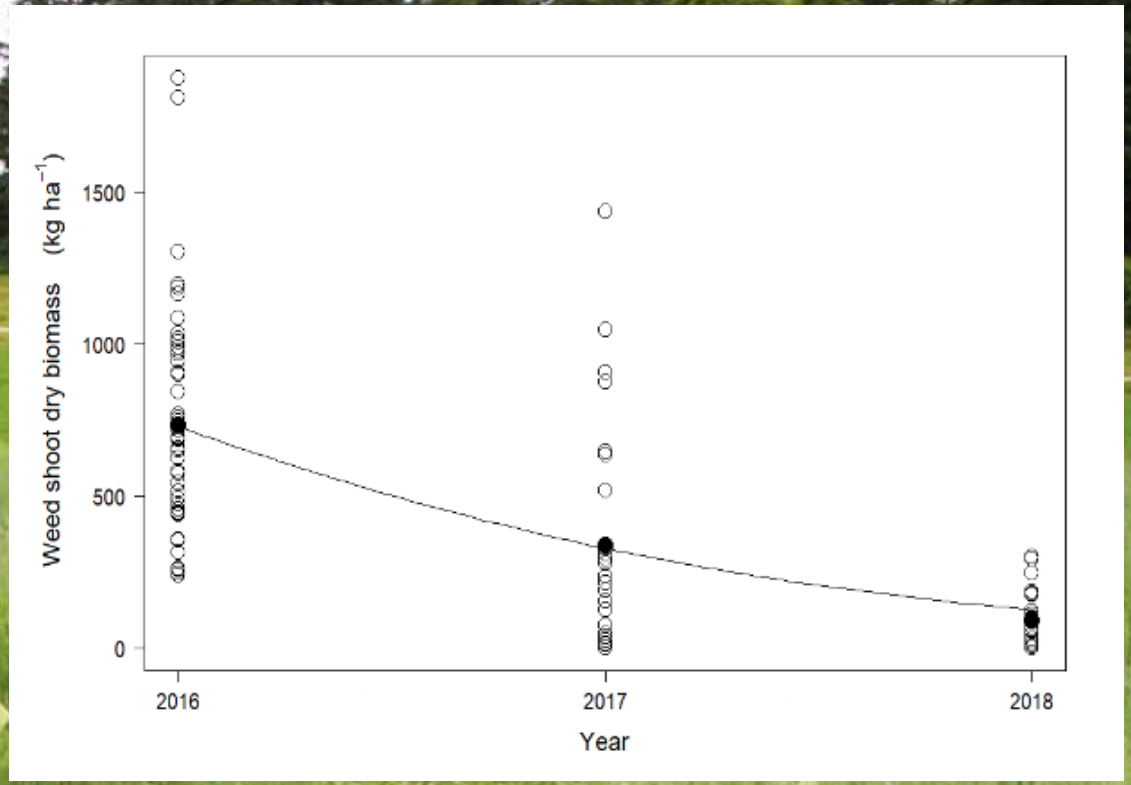
Beef cows pen study Lancaster, WI	Grass-alfalfa haylage	50-50 Kernza-haylage diet	P-value
DMI (kg cow/day)	12.7[a]	11.5[b]	< 0.01
ADG (kg/day)	0.8[a]	0.4[b]	< 0.01
Change in BCS	0.5	0.3	ns
Calf birth weight (kg)	41	41	ns
Calf wean weight (kg)	284[b]	286[b]	ns



- Kernza straw reduced dry matter intake and average daily gain of beef cows when included in 50% in their diet, cows fed Kernza straw maintained their body condition with no negative impact on calf birth and weaning weights.
- Inclusion of 20% and 40% of Kernza straw reduced dry matter intake of dairy heifers by 10%, but heifers met daily gain industry standards (0.92 kg/d).
- No effects were observed for methane emissions and N balance.

Pizarro, et al. (2025)

Kernza weed suppression and weed management



Zimbric et al. (2020)

Synthetic auxin herbicides do not injure intermediate wheatgrass or affect grain yield

Erica D. Shoenberger[1], Jacob M. Jungers[2], Eugene P. Law[3], Clair L. Keene[4], Antonio DiTommaso[5], Craig C. Sheaffer[6], Donald L. Wyse[7], Valentin D. Picasso[8] and David E. Stoltenberg[9]

Shoenberger et al. (2023)

Perennial legumes for Kernza intercropping

Red clover
Trifolium pratense

Kura clover
Trifolium ambiguum

Alfalfa (Lucerne)
Medicago sativa

Pinto et al. (2022 and 2025)

Contents lists available at ScienceDirect

Field Crops Research

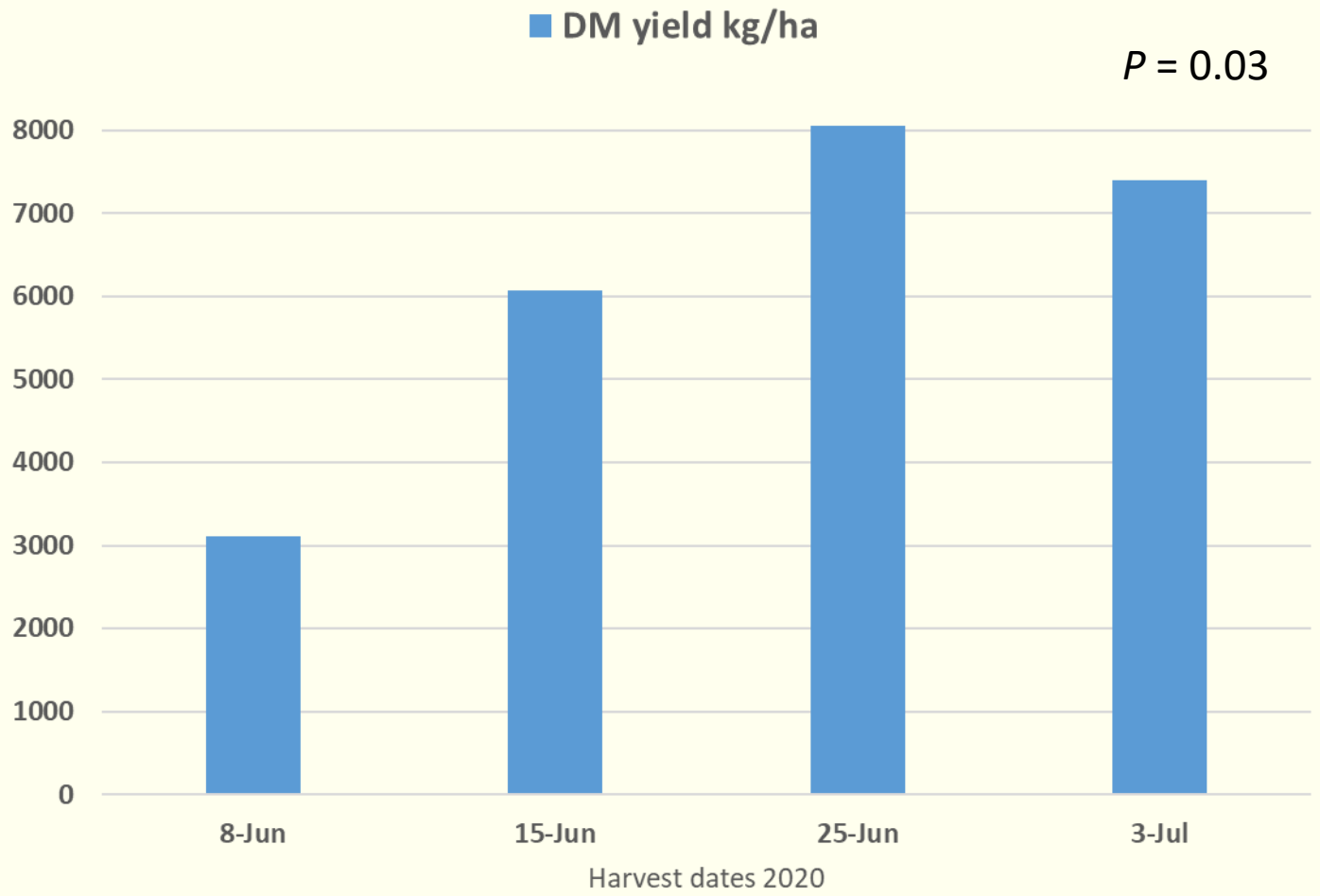
journal homepage: www.elsevier.com/locate/fcr

Forage boost or grain blues? Legume choices shape Kernza intermediate wheatgrass dual-purpose crop performance

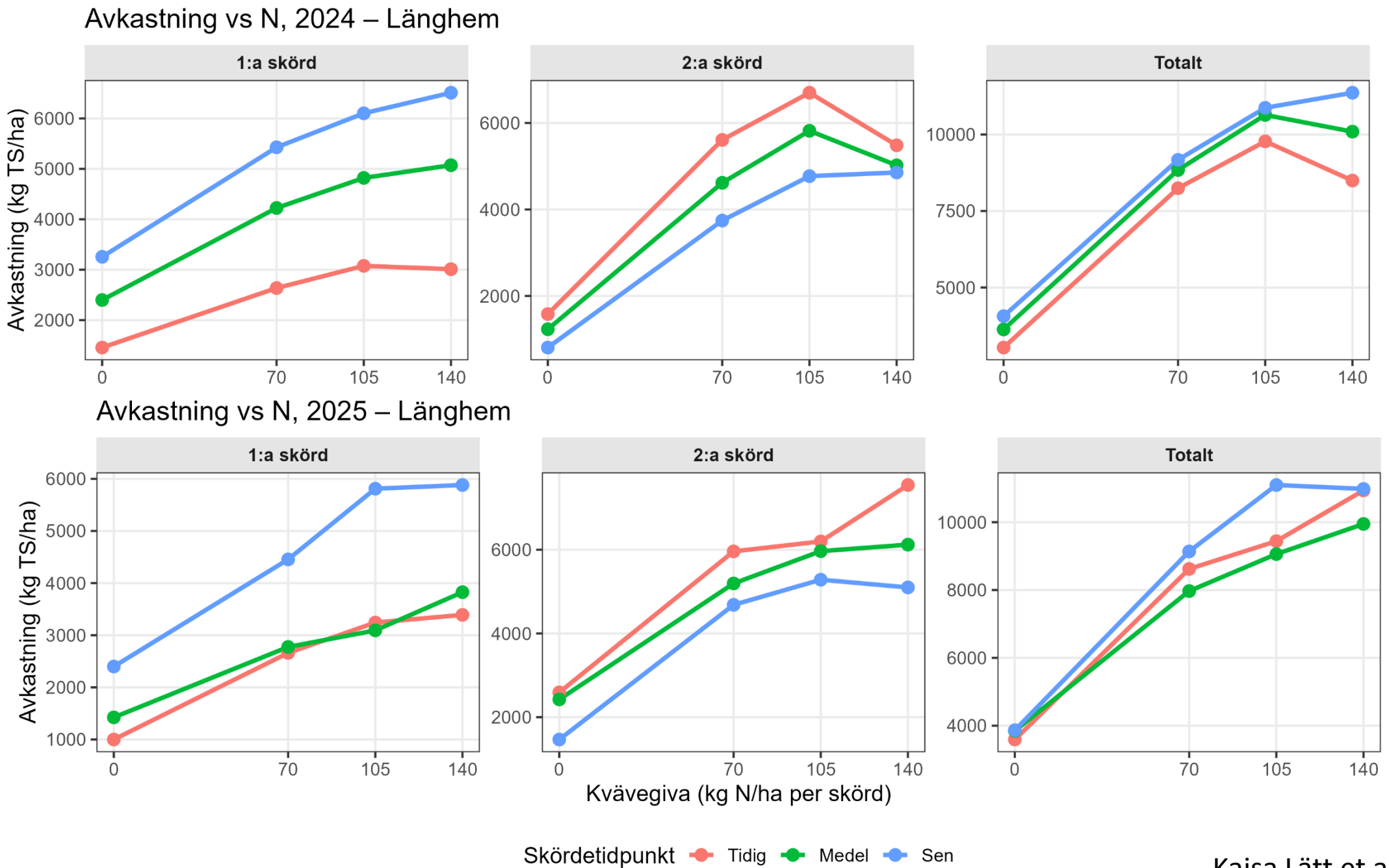
Priscila Pinto *, Stefania Cartoni-Casamitjana, David E. Stoltenberg, Valentin D. Picasso

Kernza forage yield and quality at Rådde, Sweden

Elisabet Nadeau
Ola Hallin
SLU, Skara

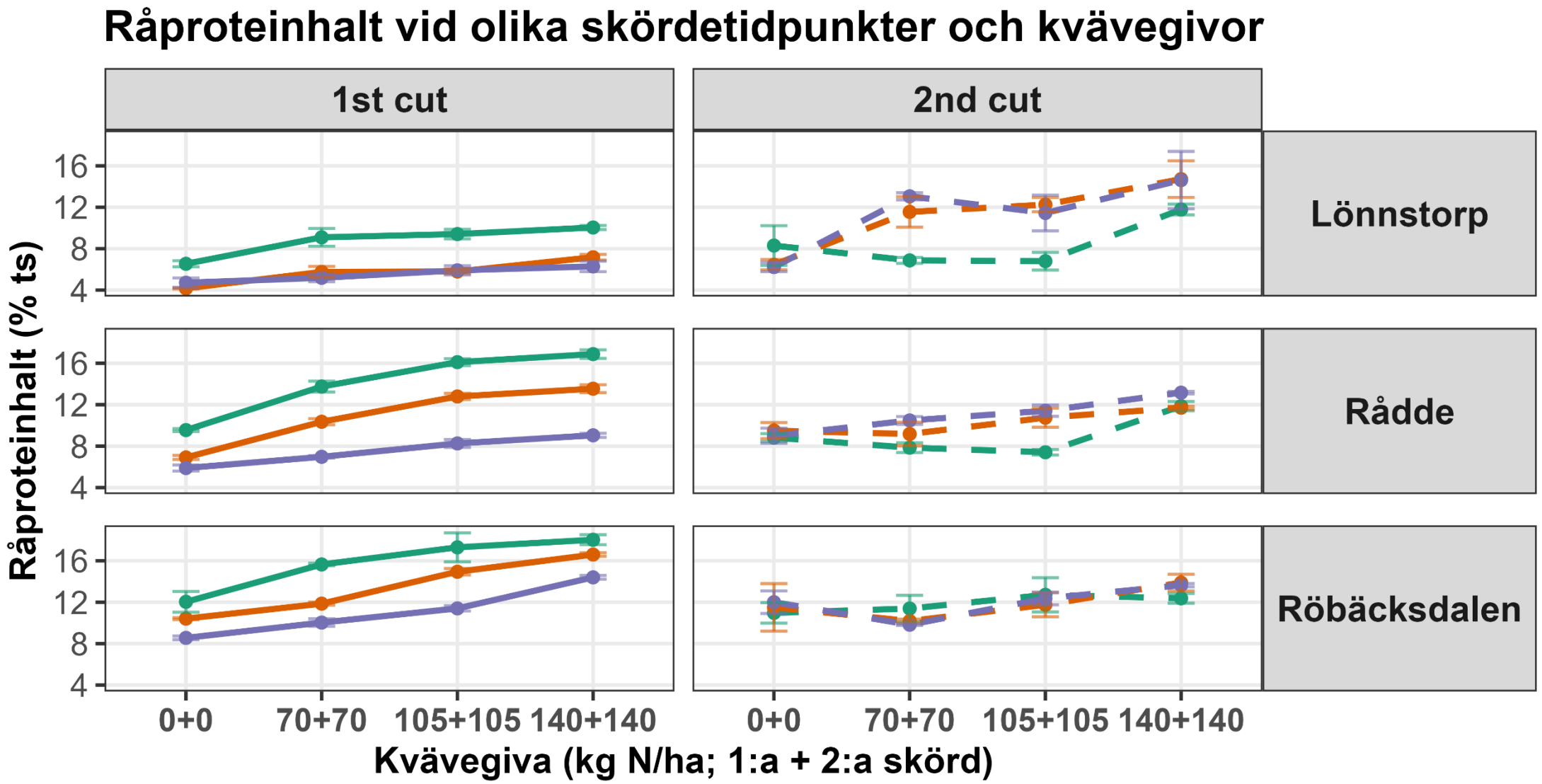


Nadeau and Picasso (2023)



Kajsa Lätt et al; SLF

2024



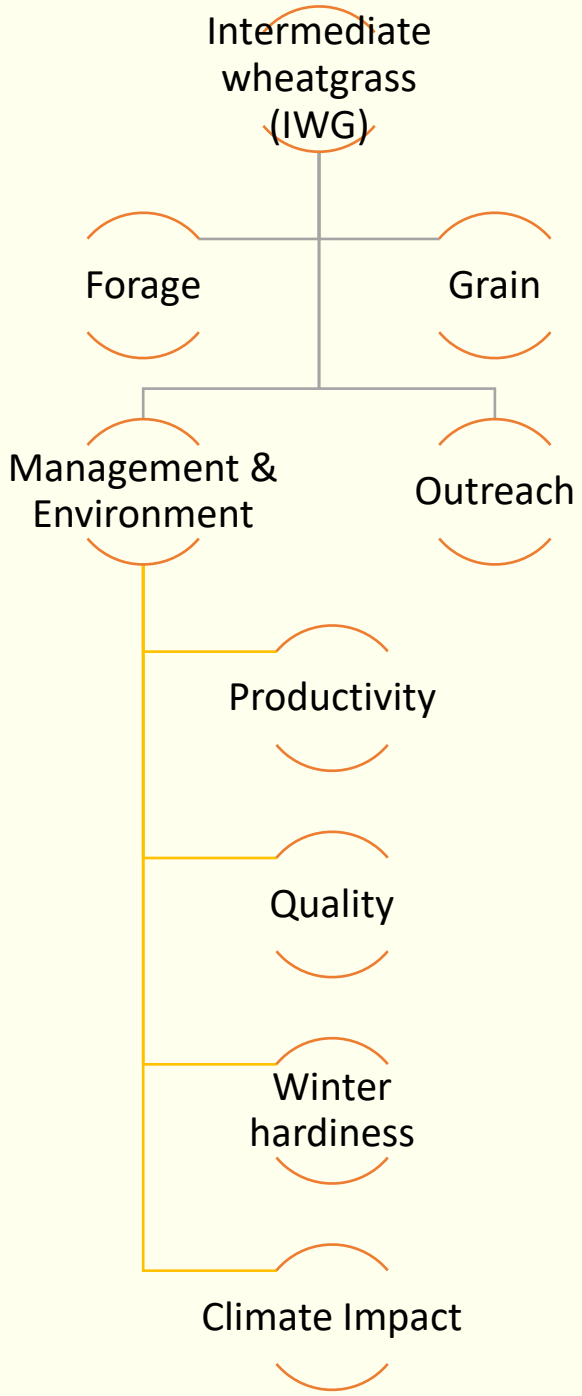
Kajsa Lätt et al; SLF

VIKING: VALIDATING THE INTRODUCTION OF KERNZA IN THE NORDIC-BALTIC REGION

Nordforsk (2023-26)

PI: Valentin Picasso, SLU

Budget: NOK 9.835.300



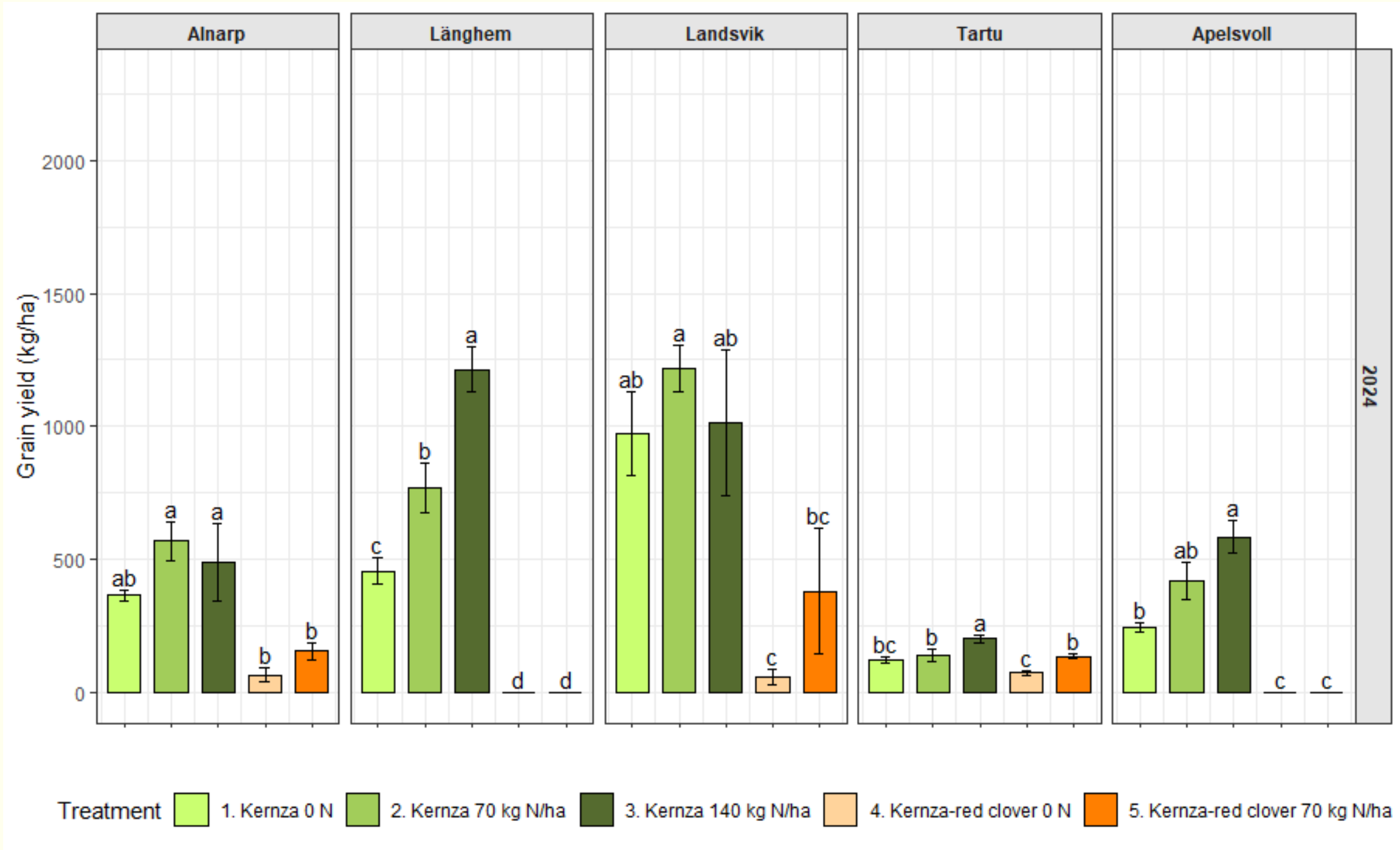
Intermediate wheatgrass (IWG)

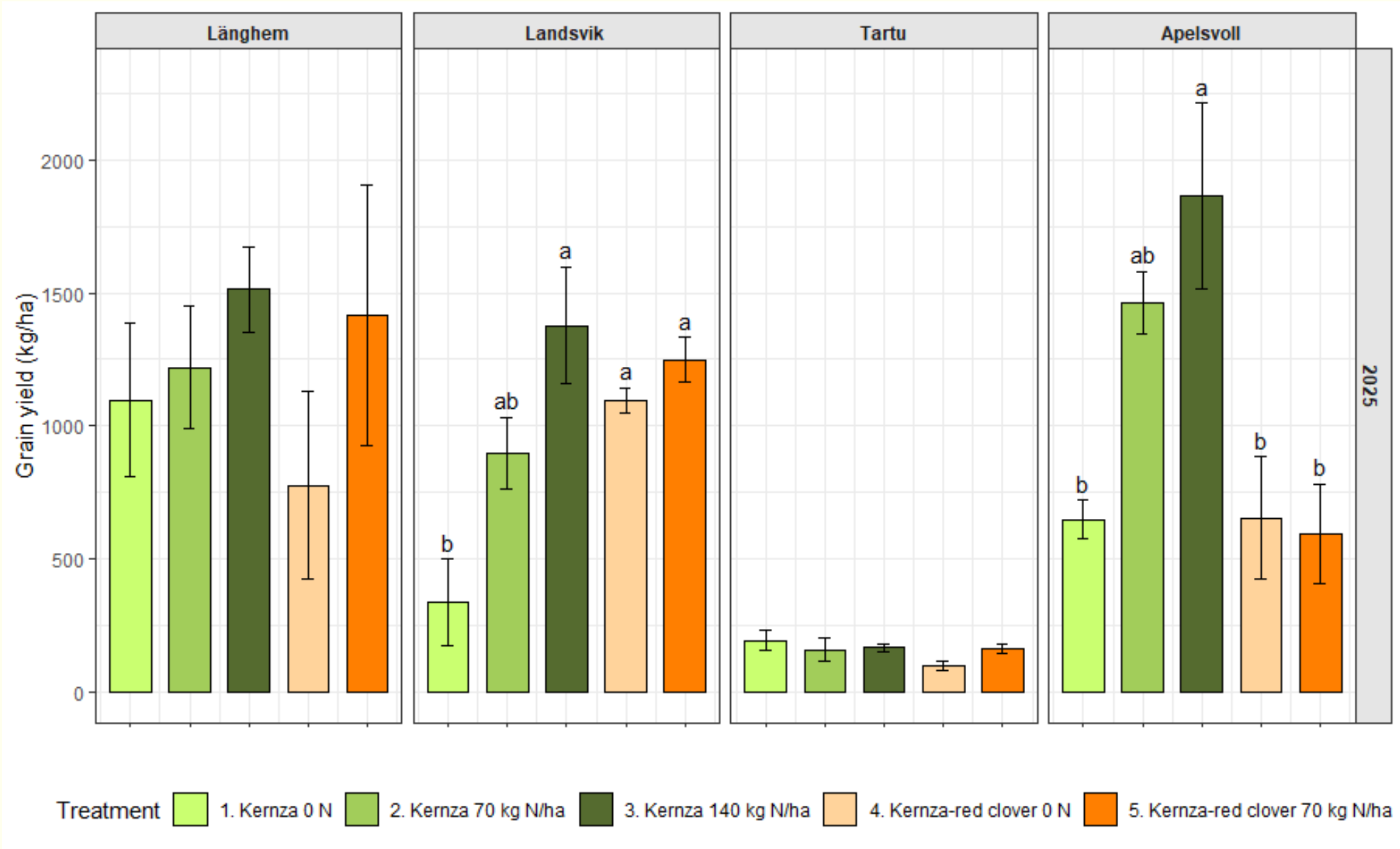
- Dual purpose crop
- Agronomic management practices to optimise grain yield, forage yield, grain and forage quality
- Adaptation and potential of grain and forage production and quality of Kernza across the Nordic and Baltic region
- Field experiments (WP 1 and 2)
- Effects of fertilisation, harvest, intercropping and local conditions
  - Productivity (WP 1 and 2)
  - Quality (WP 1 and 2)
  - Winter hardiness (WP 3)
  - Climate impact (WP 4)
- Demonstration sites and outreach (WP 5)
- Develop a strong research platform for perennial cereal production systems in Scandinavia, Finland and the Baltics

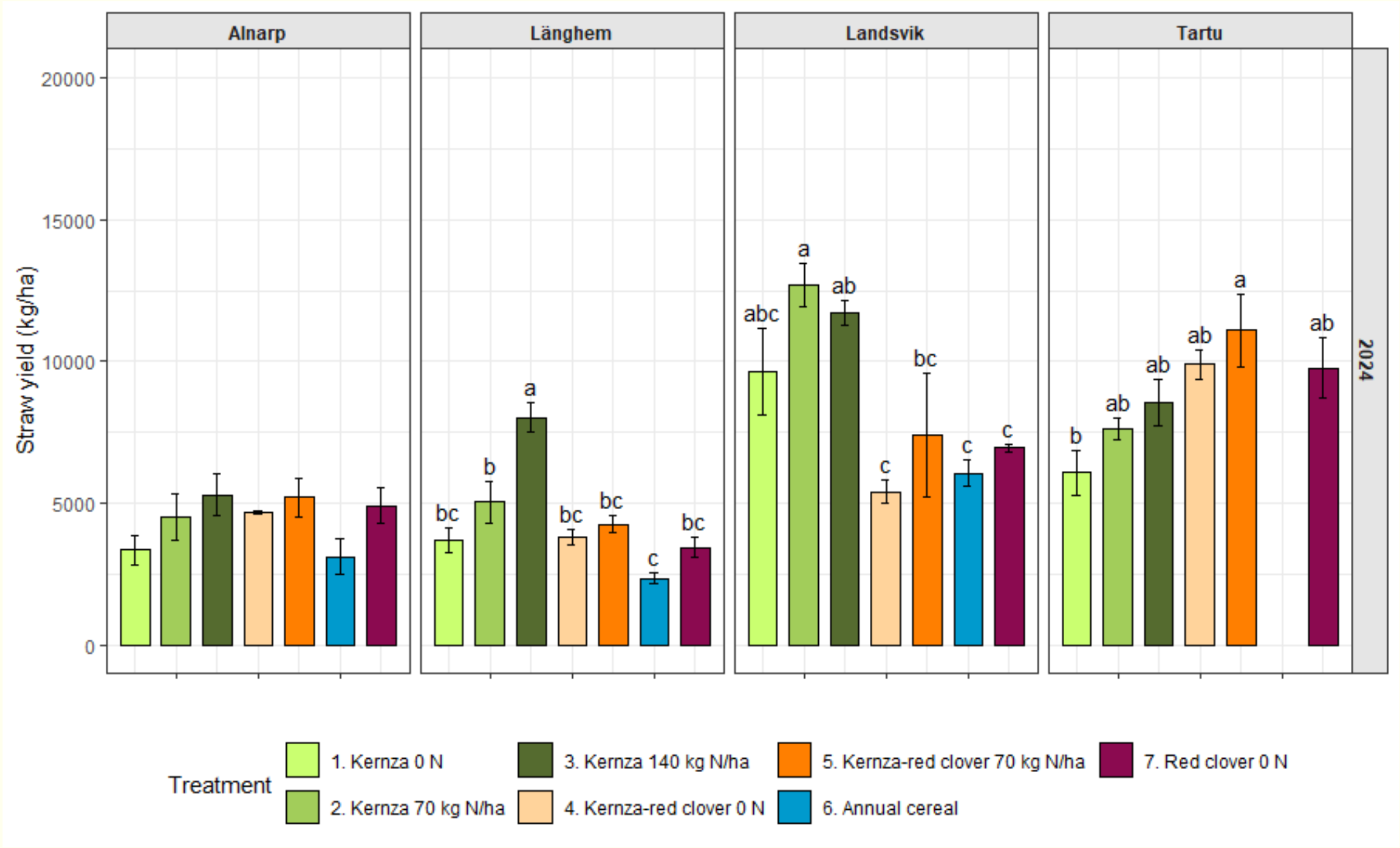
Treatments

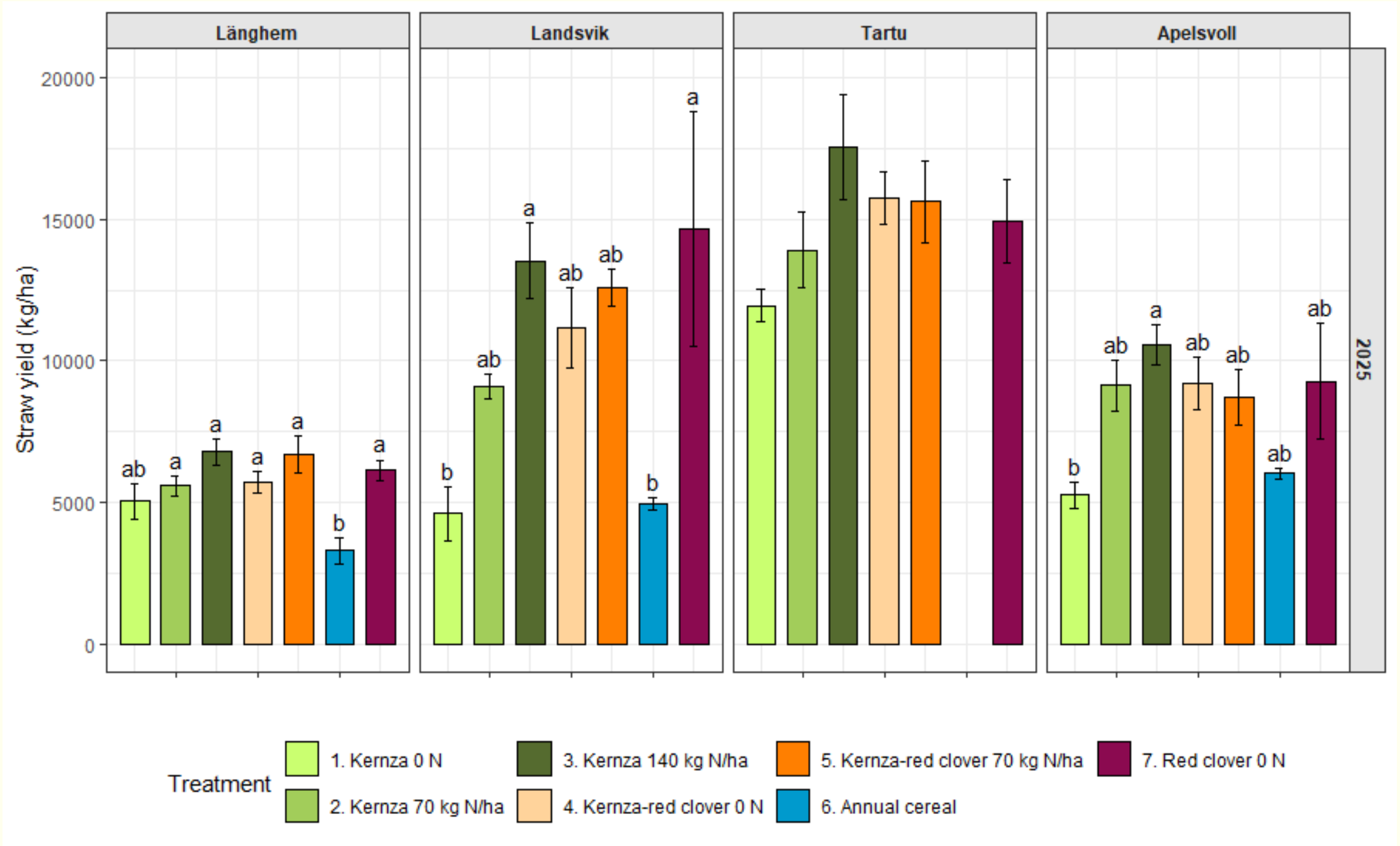
Crop	Fertilisation
Kernza monoculture	0 kg N per ha
	60 kg N per ha
	120 kg N per ha
Kernza - red clover intercrop	0 kg N per ha
	60 kg N per ha
Annual cereal rotation	120-220 kg N per ha as control
Red clover monoculture	0 kg N per ha as control

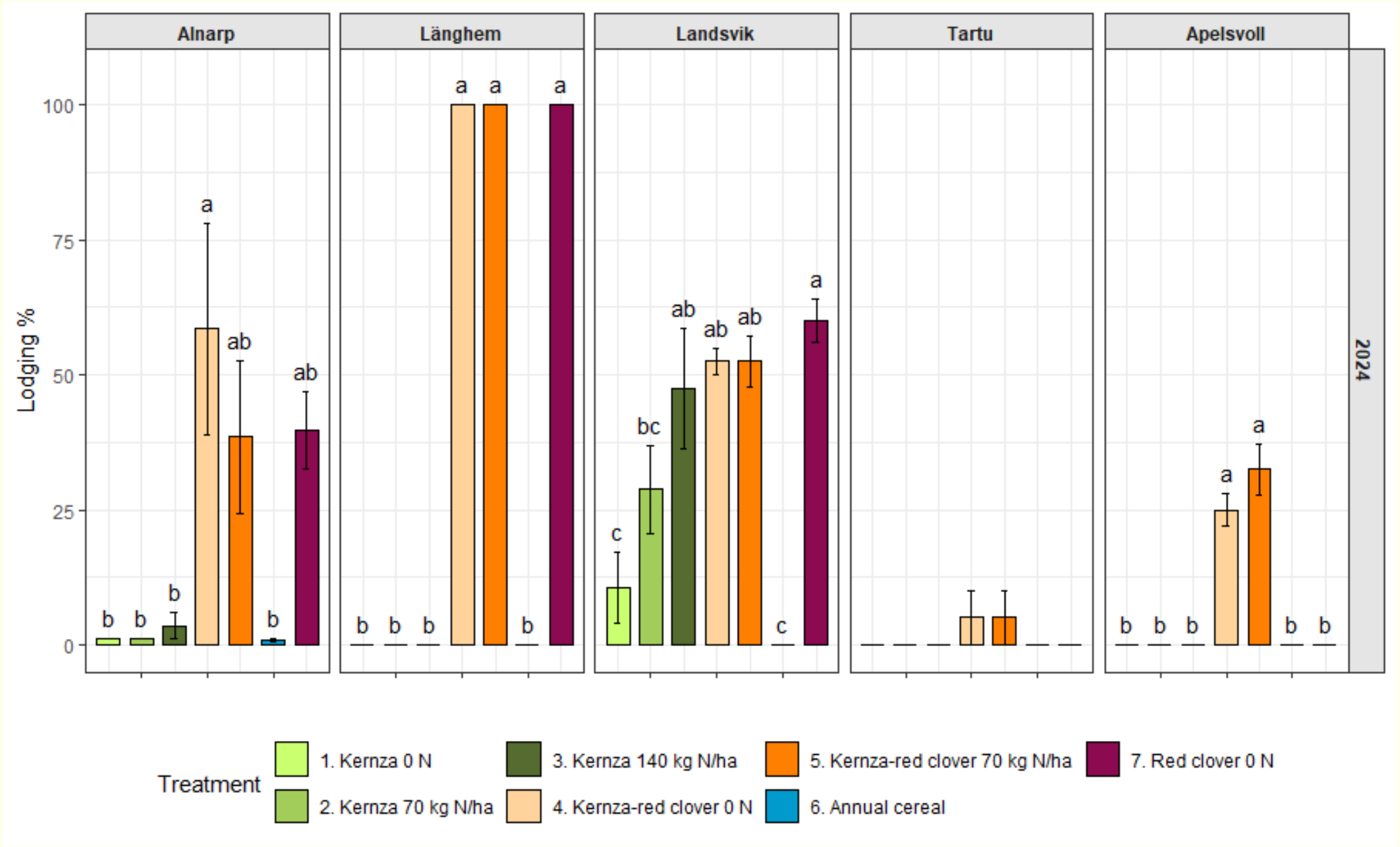
Organisation	Location
Estonian University of Life Sciences	Tartu, Estonia
Natural Resources Institute Finland	Jokioinen, Finland
Vytautas Magnus University	Kaunas, Lithuania
The Norwegian Institute of Bioeconomy Research	Landvik and Apelsvoll, Norway
SITES Research Station, SLU Lönnstorp	Alnarp, Sweden
Hushållningssällskapet Sjuhärad	Rådde, Sweden


Alnarp
Länghem
Landsvik
Tartu
Apelsvoll
2024
Grain yield (kg/ha)
0
500
1000
1500
2000
ab
a
a
b
b
c
b
a
d
d
ab
a
ab
c
bc
bc
b
a
c
b
b
ab
a
c
c
Treatment
1. Kernza 0 N
2. Kernza 70 kg N/ha
3. Kernza 140 kg N/ha
4. Kernza-red clover 0 N
5. Kernza-red clover 70 kg N/ha


Länghem
Landsvik
Tartu
Apelsvoll
2025
Grain yield (kg/ha)
0
500
1000
1500
2000
b
ab
a
a
a
b
ab
a
b
b
Treatment
1. Kernza 0 N
2. Kernza 70 kg N/ha
3. Kernza 140 kg N/ha
4. Kernza-red clover 0 N
5. Kernza-red clover 70 kg N/ha


Alnarp
Länghem
Landsvik
Tartu
2024
Straw yield (kg/ha)
20000
15000
10000
5000
0
bc
b
a
bc
bc
c
bc
abc
a
ab
c
bc
c
c
b
ab
ab
ab
a
ab
Treatment
1. Kernza 0 N
2. Kernza 70 kg N/ha
3. Kernza 140 kg N/ha
4. Kernza-red clover 0 N
5. Kernza-red clover 70 kg N/ha
6. Annual cereal
7. Red clover 0 N


Länghem
Landsvik
Tartu
Apelsvoll
2025
Straw yield (kg/ha)
20000
15000
10000
5000
0
ab a a a a b a
b ab a ab ab b a
a
ab a ab ab b ab
Treatment
1. Kernza 0 N
2. Kernza 70 kg N/ha
3. Kernza 140 kg N/ha
4. Kernza-red clover 0 N
5. Kernza-red clover 70 kg N/ha
6. Annual cereal
7. Red clover 0 N


Alnarp
Länghem
Landsvik
Tartu
Apelsvoll
2024
Lodging %
100
75
50
25
0
a
ab
ab
b
b
b
a
a
a
b
b
b
b
c
bc
ab
ab
ab
a
c
b
b
b
a
a
b
b
Treatment
1. Kernza 0 N
2. Kernza 70 kg N/ha
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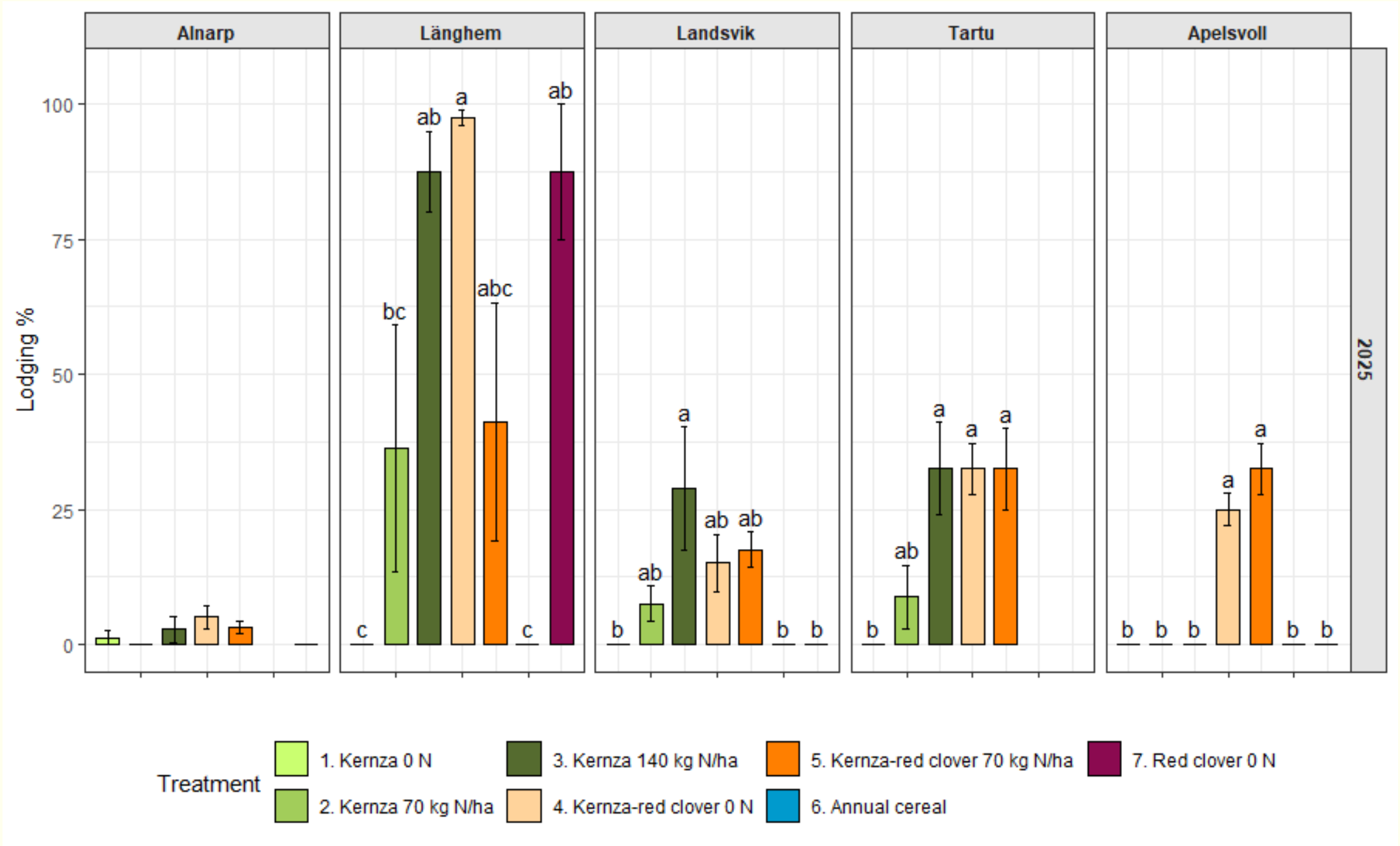
Alnarp
Länghem
Landsvik
Tartu
Apelsvoll
2025
Lodging %
100
75
50
25
0
c
bc
ab
a
abc
ab
b
ab
a
ab
ab
b
b
b
ab
a
a
a
b
b
b
a
a
b
b
b
Treatment
1. Kernza 0 N
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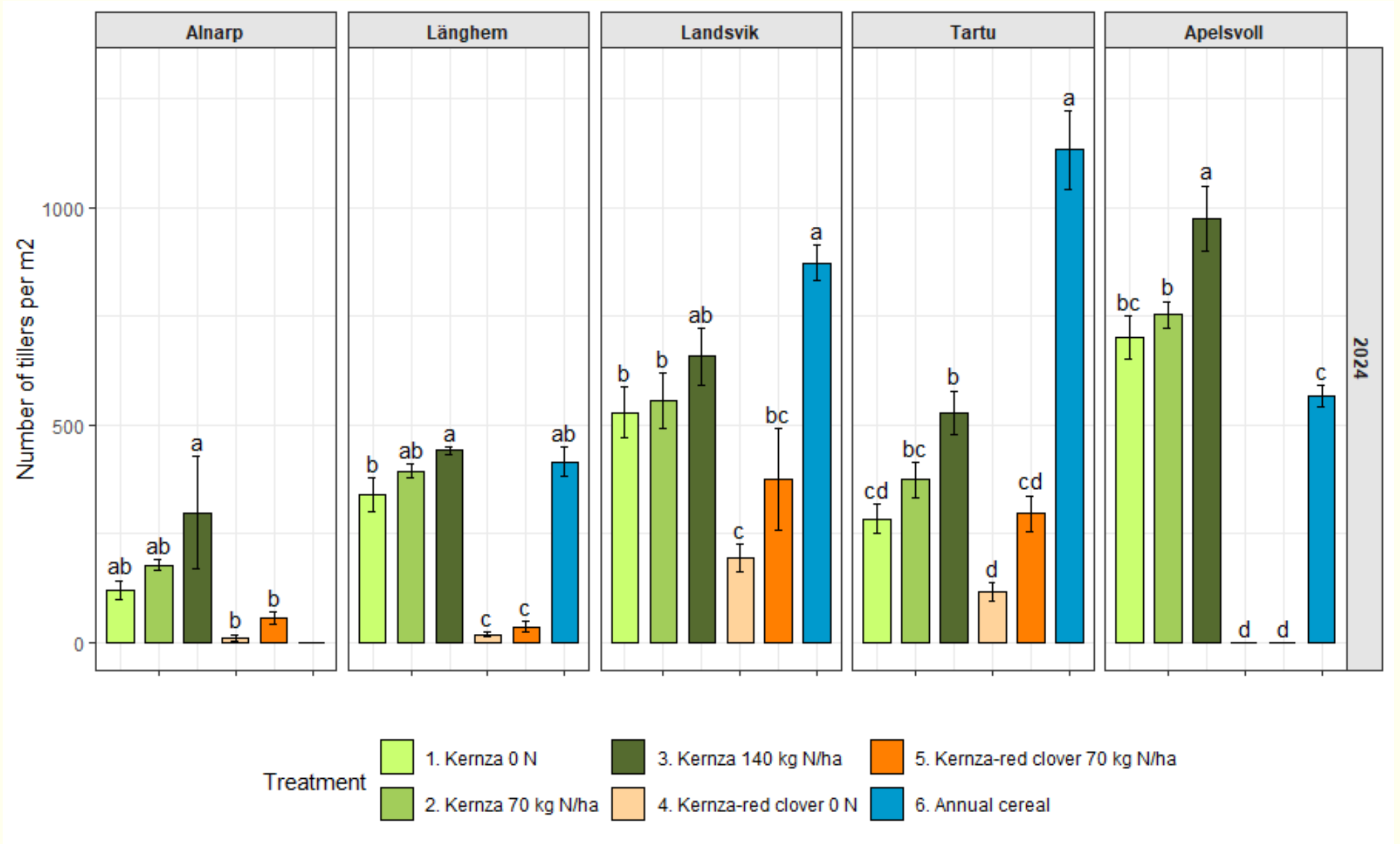
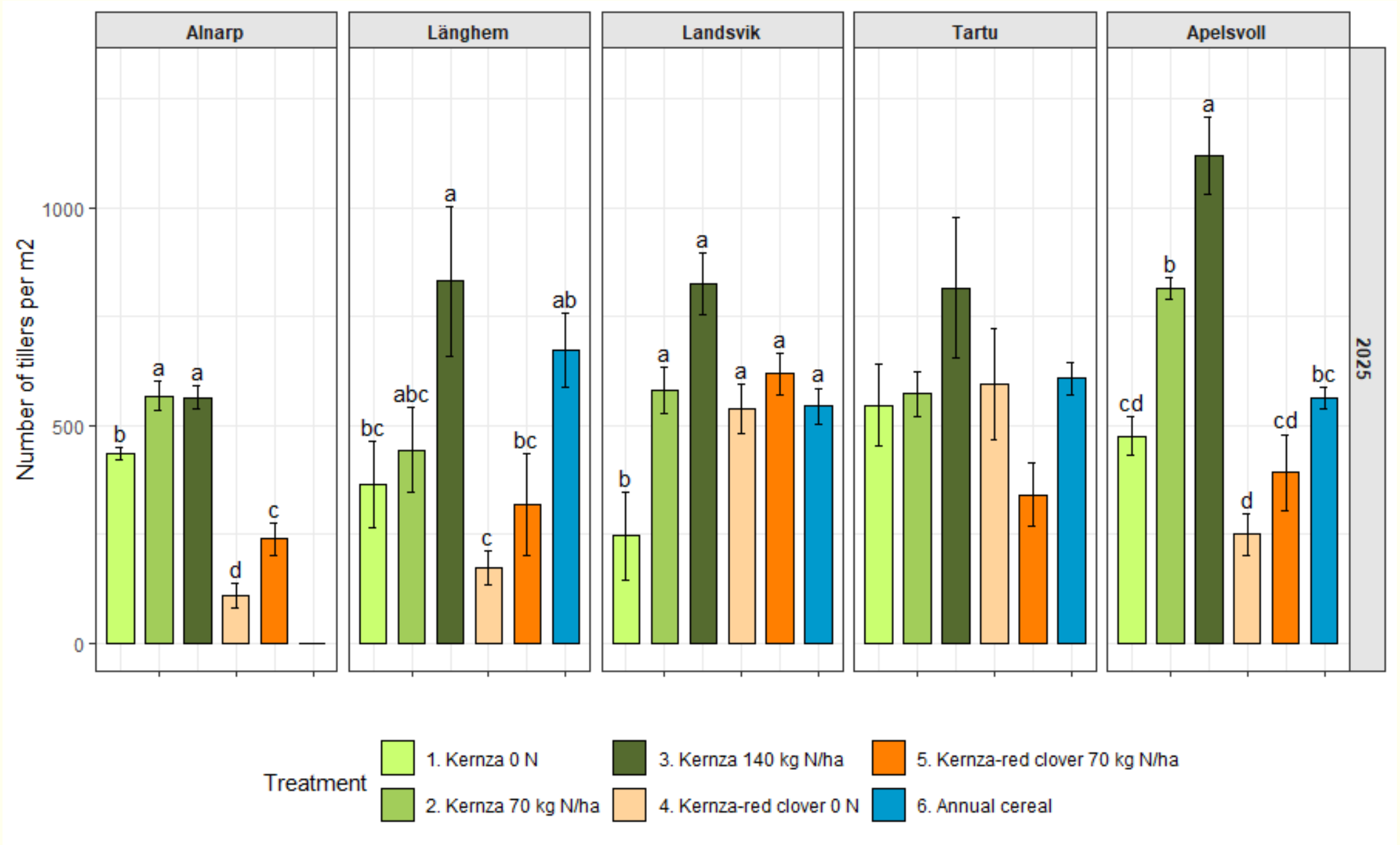

Alnarp
Länghem
Landsvik
Tartu
Apelsvoll
2024
Number of tillers per m2
0
500
1000
ab ab a b b
b ab a c c ab
b b ab c bc a
cd bc b d cd a
bc b a d d c
Treatment
1. Kernza 0 N
2. Kernza 70 kg N/ha
3. Kernza 140 kg N/ha
4. Kernza-red clover 0 N
5. Kernza-red clover 70 kg N/ha
6. Annual cereal


Alnarp
Länghem
Landsvik
Tartu
Apelsvoll
2025
Number of tillers per m2
0
500
1000
b
a
a
d
c
bc
abc
a
c
bc
ab
b
a
a
a
a
a
cd
b
a
d
cd
bc
Treatment
1. Kernza 0 N
2. Kernza 70 kg N/ha
3. Kernza 140 kg N/ha
4. Kernza-red clover 0 N
5. Kernza-red clover 70 kg N/ha
6. Annual cereal

In summary

- Successful Nordic-Baltic collaboration
- Feasibility of perennial grain crops in the region
- High potential of Kernza as dual-use crop (forage and grain)
- Variability of results with locations
- Future analyses: grain and forage quality, physiological trade-offs, economics
- Need for breeding, testing, and more research in the region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