Seed viability of *ex situ* conserved wheat & barley is poorly maintained at 4°C storage

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Plant gene banks

- ## *Ex situ* seed storage

  - Seed ageing postponed as long as possible

  - Empirical data on seed longevity rather scarce

  - Low seed MC and low temperature recommended

    - Long-term storage (base collection): -18 ± 3°C

    - Medium-term storage (active collection): 5-10°C

- ## Theory (seed information database Kew)

Seed viability to fall from 95% to 80% (years)		
	-20°C	**4°C**
Wheat	424	105
Barley	573	142

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CGN

- **~23,000 accessions**
  - Wheat: ~5000
  - Barley: ~2700
- **Seed drying**
  - 15°C and 15% RH for 2 months
- **Seed storage**
  - Vacuum conditions
  - Base collection: -20°C
  - Active collection: 4°C

Viability of CGN accessions

- **Initial viability**
  - 80% for cultivated materials
  - 60% for crop wild relatives

- **Viability monitoring**
  - Base collection: monitoring program by CGN
  - Active collection: feedback from user community
   - Low germination reported since 2007 for wheat

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Germination study at CGN

- Materials from 5 different regeneration years

  - Wheat: 1978-1979, 1984-1986; barley: 1985-1989

- 25 randomly chosen accessions per regeneration year

- Comparison seeds stored at -20°C and 4°C

- 100 seeds tested per sample

- Test performed in trays with compost in greenhouse

  - Wheat: 2011; barley: 2012

- Scoring of normal seedlings

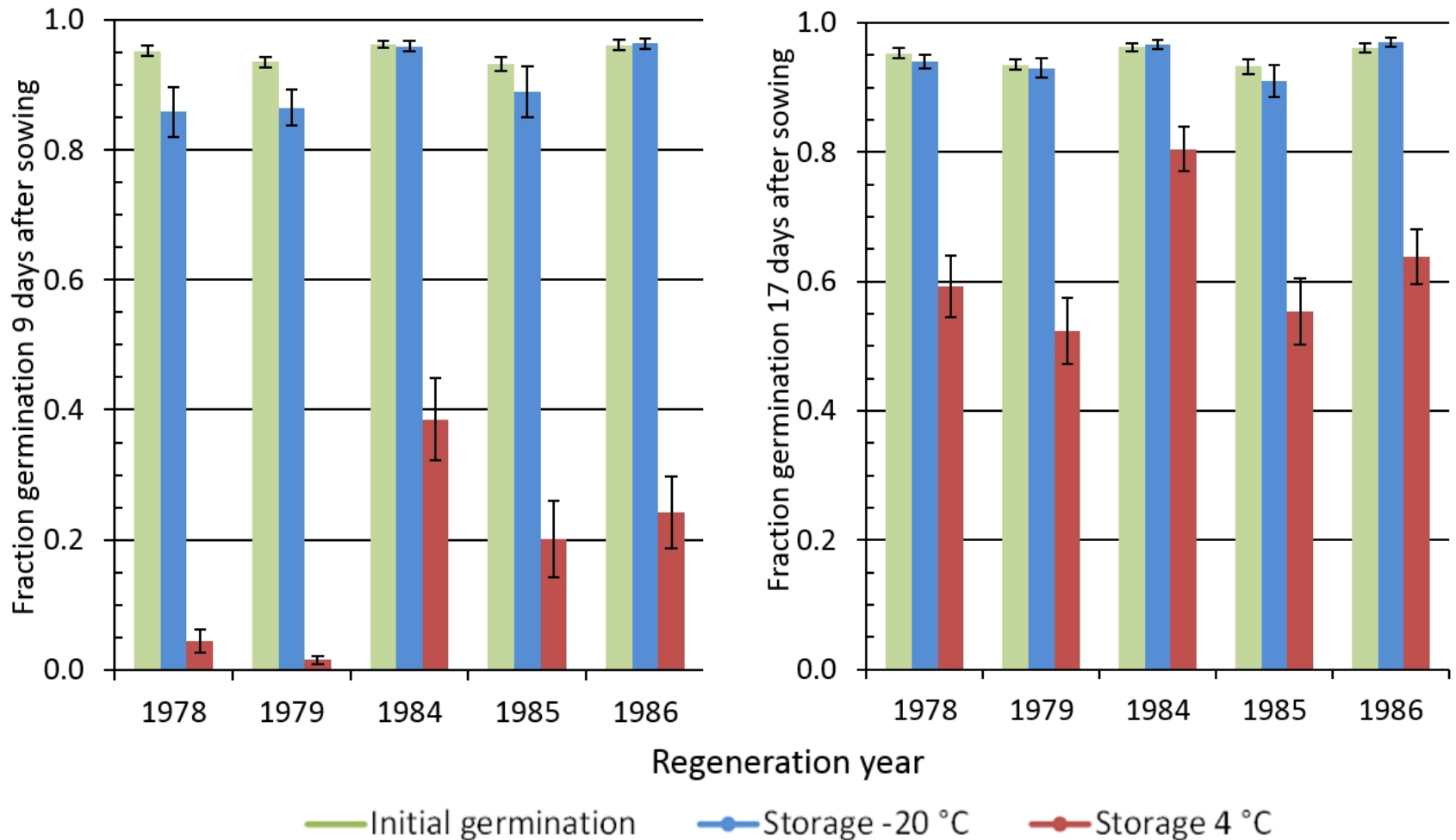- 25 wheat accessions retested in 2017
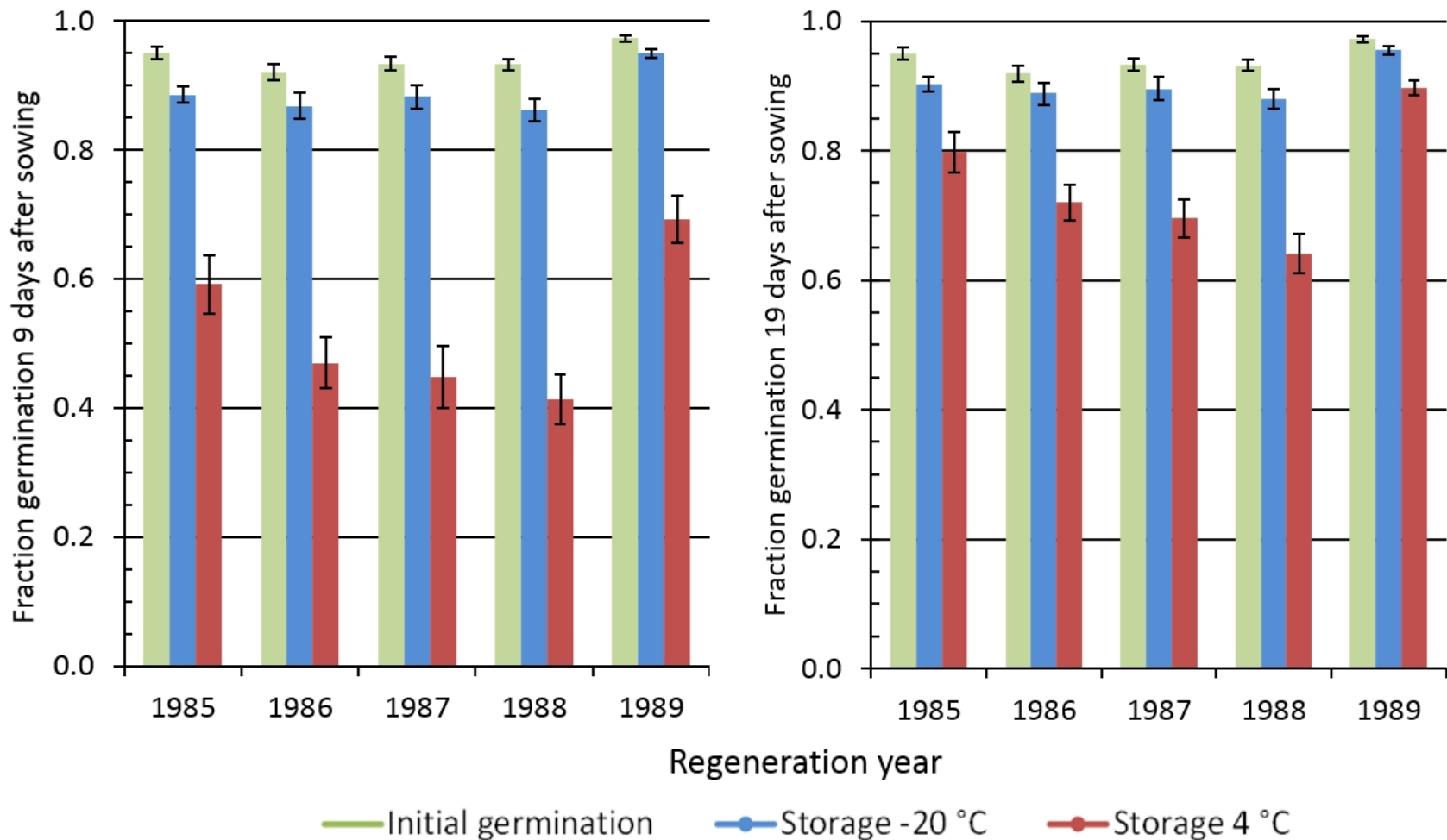

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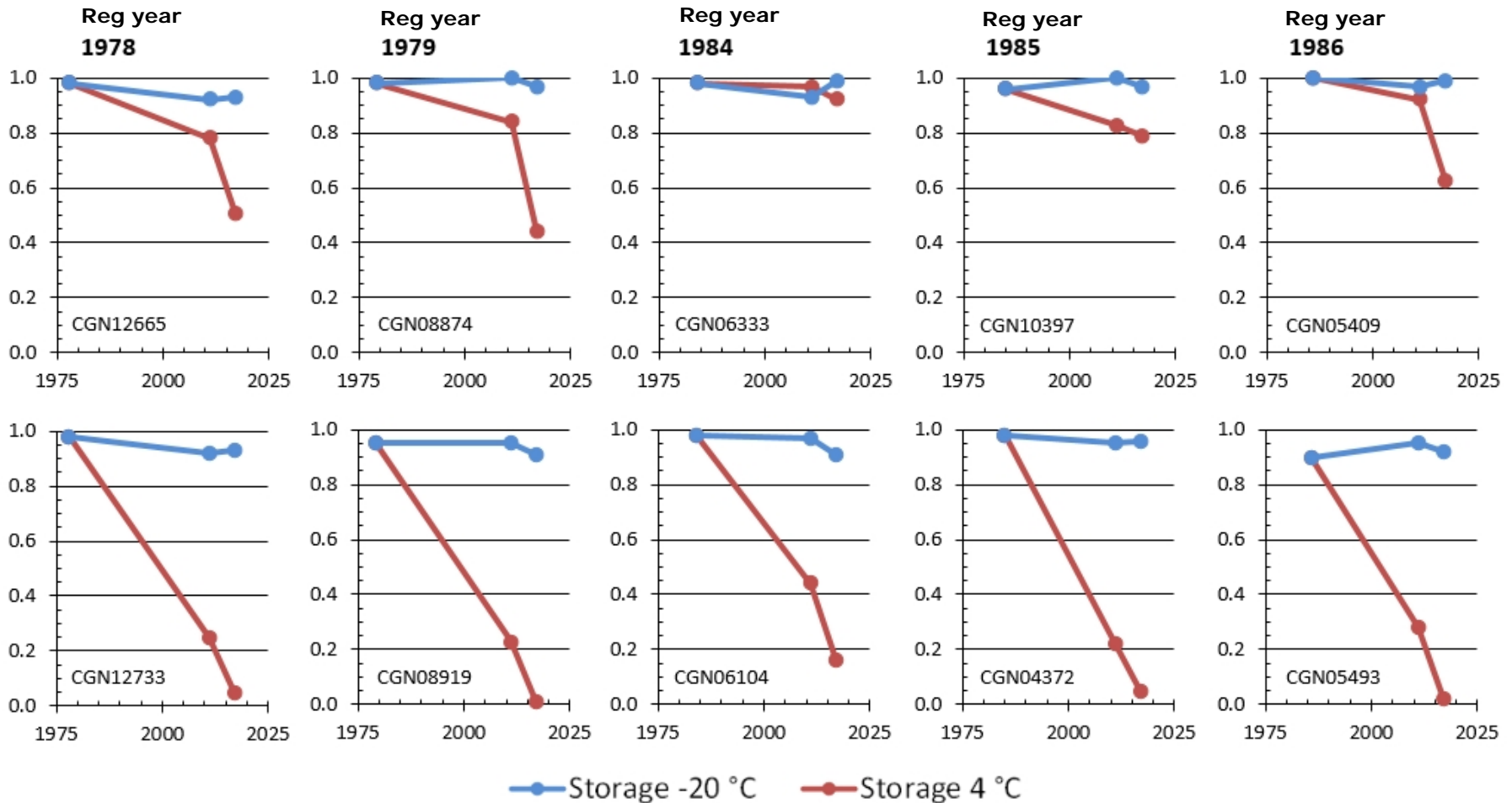UNIVERSITY & RESEARCH

Progress of germination
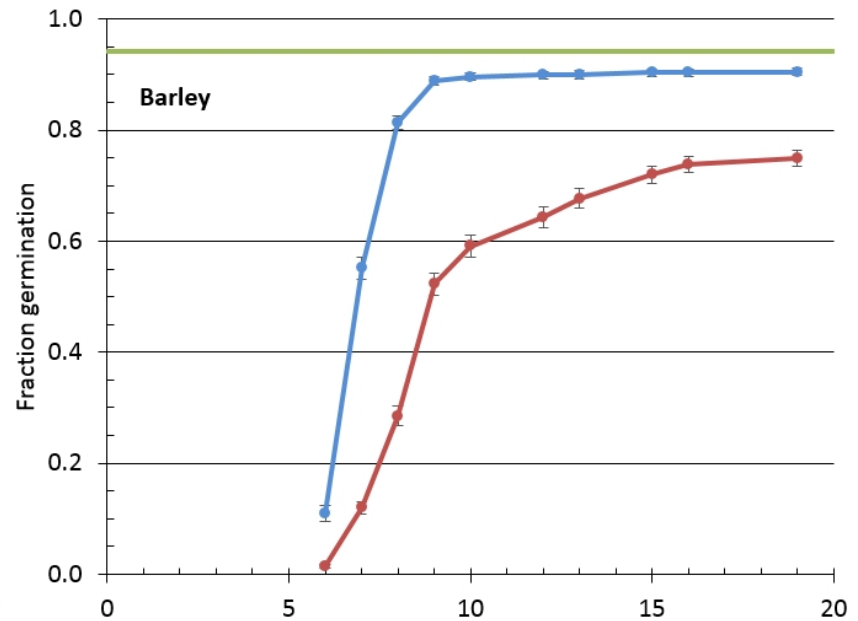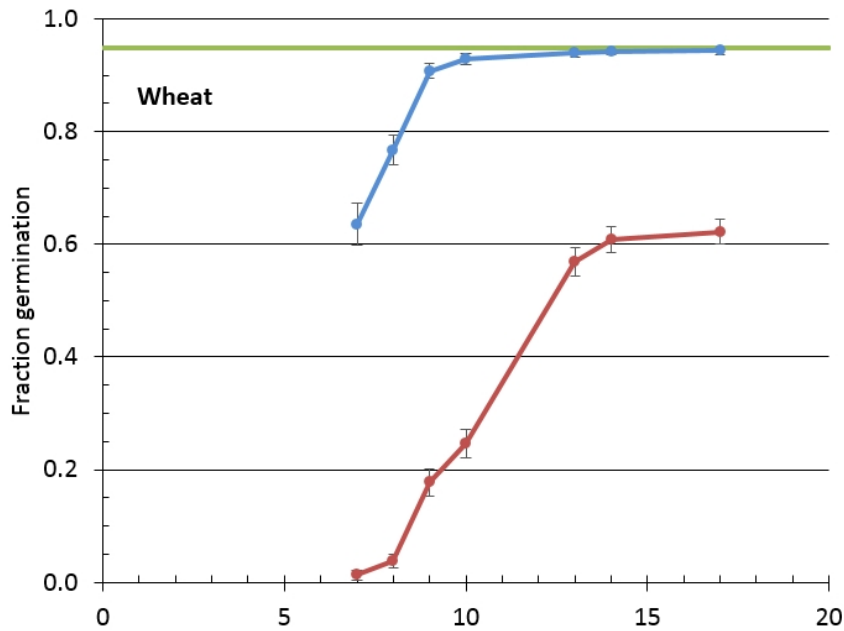
Wheat mean germination

Barley mean germination

Wheat temporal changes in germination

Conclusions

- Wheat & barley samples stored at -20°C at CGN maintained their high viability for up to 40 years

- Samples stored at 4°C at CGN showed severe reductions in viability within the same time frame

- The reductions at 4°C occurred considerably faster than could be expected from theory

- Seed storage at 4°C should be treated with caution by gene banks

  - Distribution of low viability seeds is a poor service to the user community

  - Risk of loosing genetic resources when applied to the base collection

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