Nitrogen use efficiency in old and modern barley genotypes

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Content of presentation

- Materials and methods
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- Results
- Conclusions
- Acknowledgements

Materials and methods

- 195 barley genotypes
  - 72 NordGen genotypes + 123 cultivars (from 1930's till 2010)
- 2 nitrogen rates: 35 and 70 kg N/ha
  - 3 replicates
  - 9 unfertilized genotypes
- Observations
  - heading, maturity, canopy height, lodging
- Plant samples (50 plants per plot)
  - at heading → biomass and N content
  - at maturity → biomass, grain yield, N content, HI, NHI
- Harvesting
  - grain yield (kg/ha)
  - NUE, NUTE, NUPE
- SNP genotyping
  - 1536 SNP-markers (UCLA)
  - Associate mapping: N use indices, disease resistance

70 kg N
35 kg N
Unfertilized plots

Definitions

NUE: nitrogen use efficiency

kg grain/kg available N (fertilizer N + soil N)

kg grain/kg fertilizer N

Subcomponents of NUE:

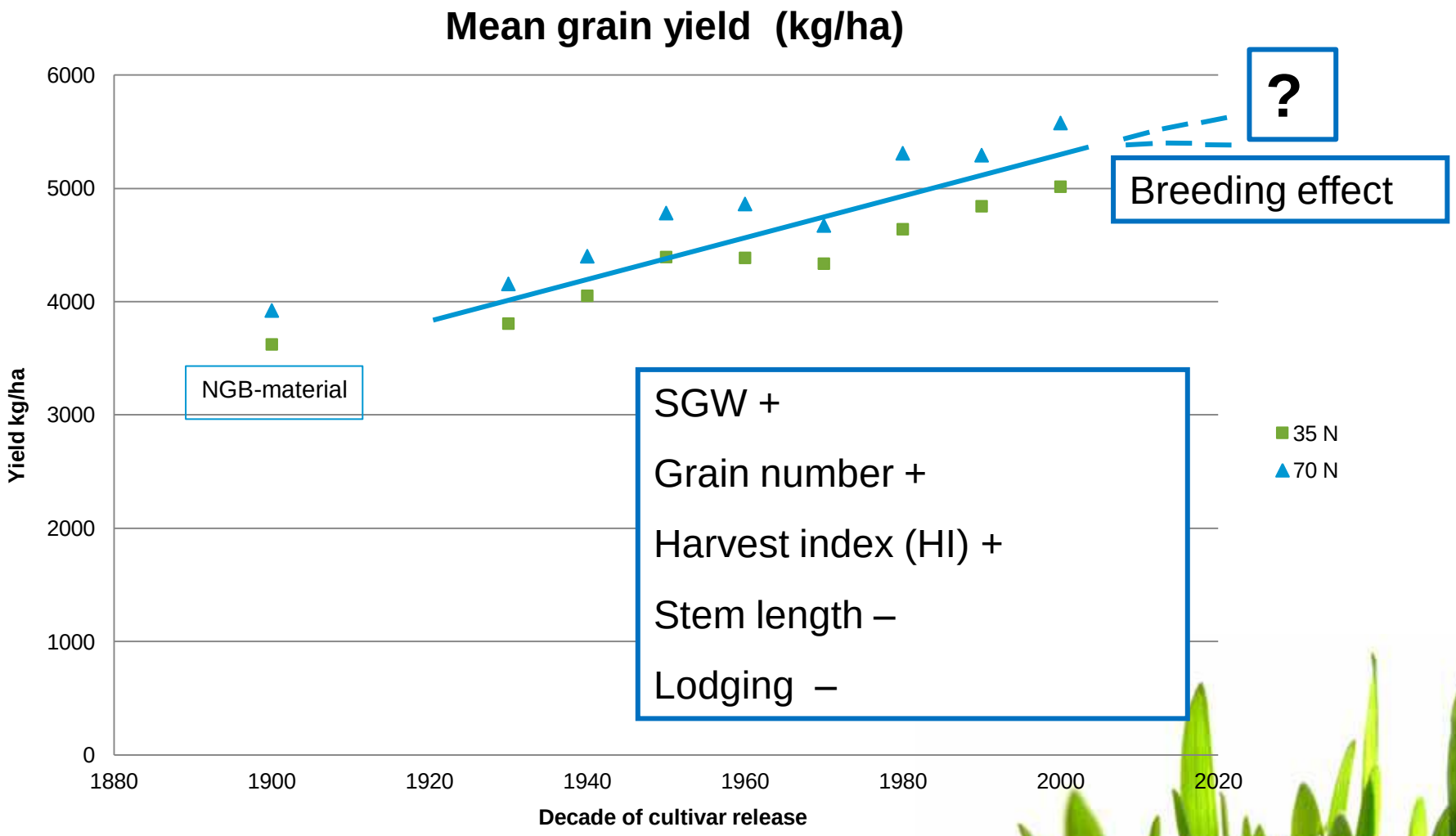
NUPE: nitrogen uptake efficiency

kg plant N/kg available N (fertilizer N + soil N)

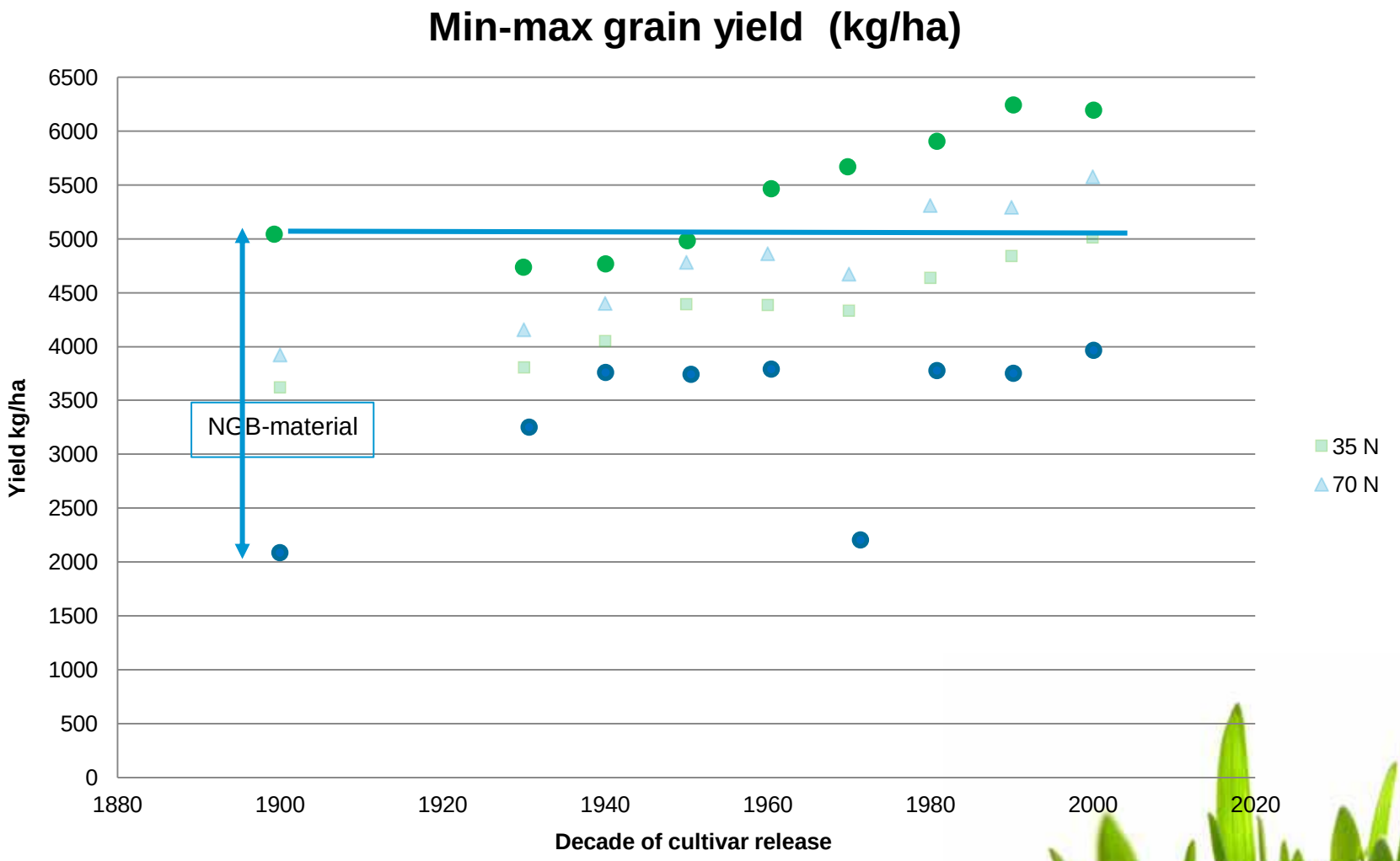
NUTE: nitrogen utilization efficiency

kg grain/kg plant N (straw + grain N)

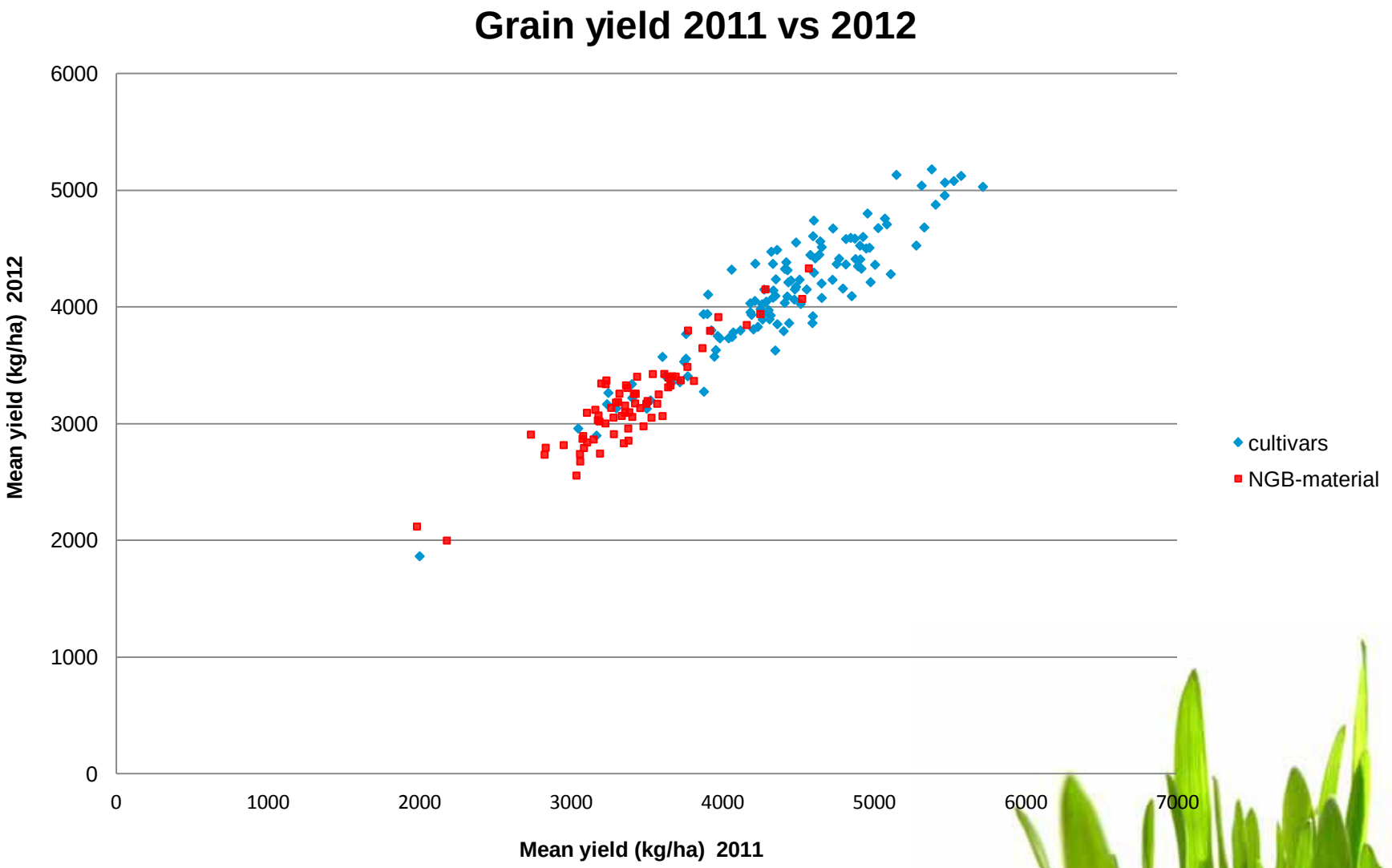
Grain yield (kg/ha) 2011+12



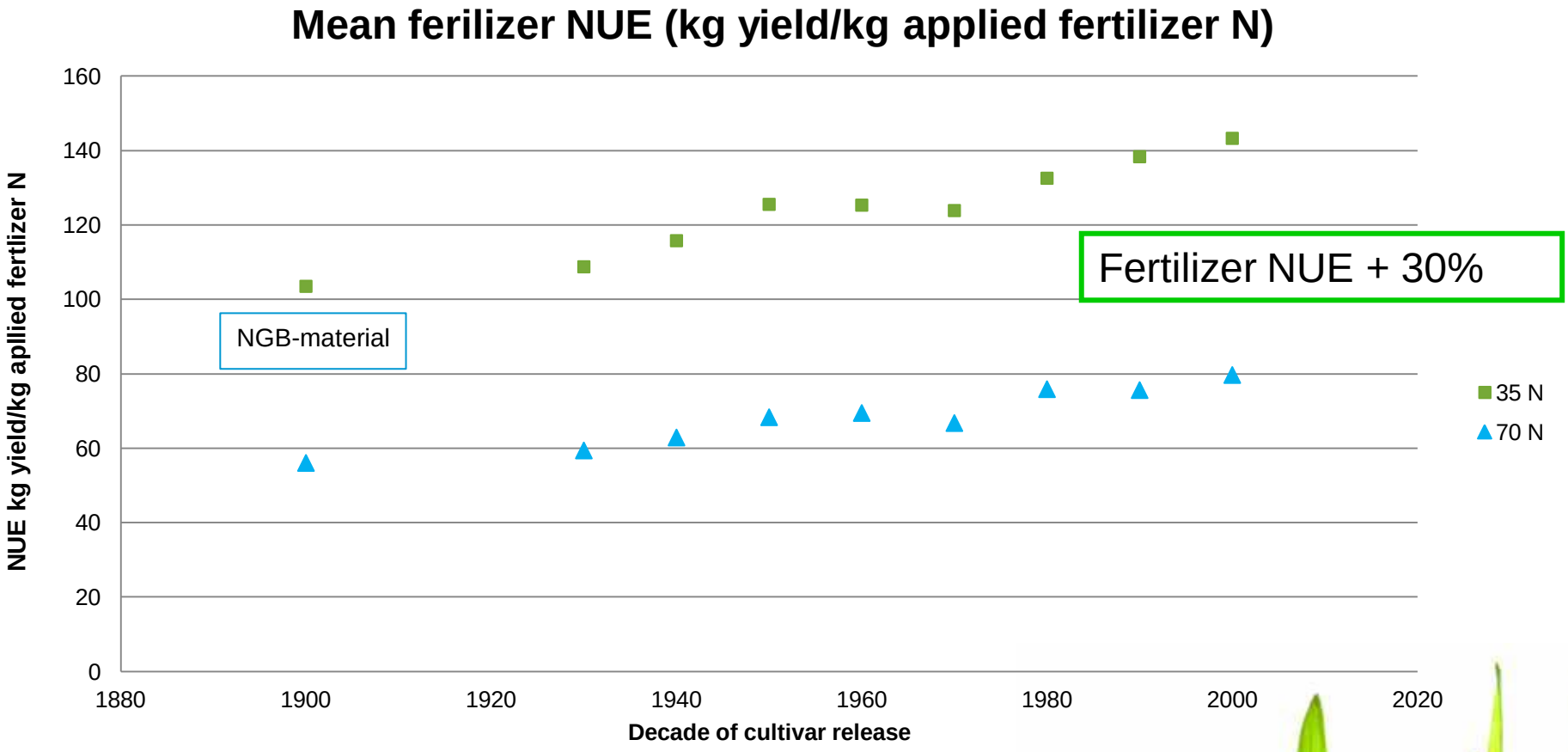
Min-max grain yield (kg/ha) 2011+12



Mean grain yield (kg/ha) 2011 vs12

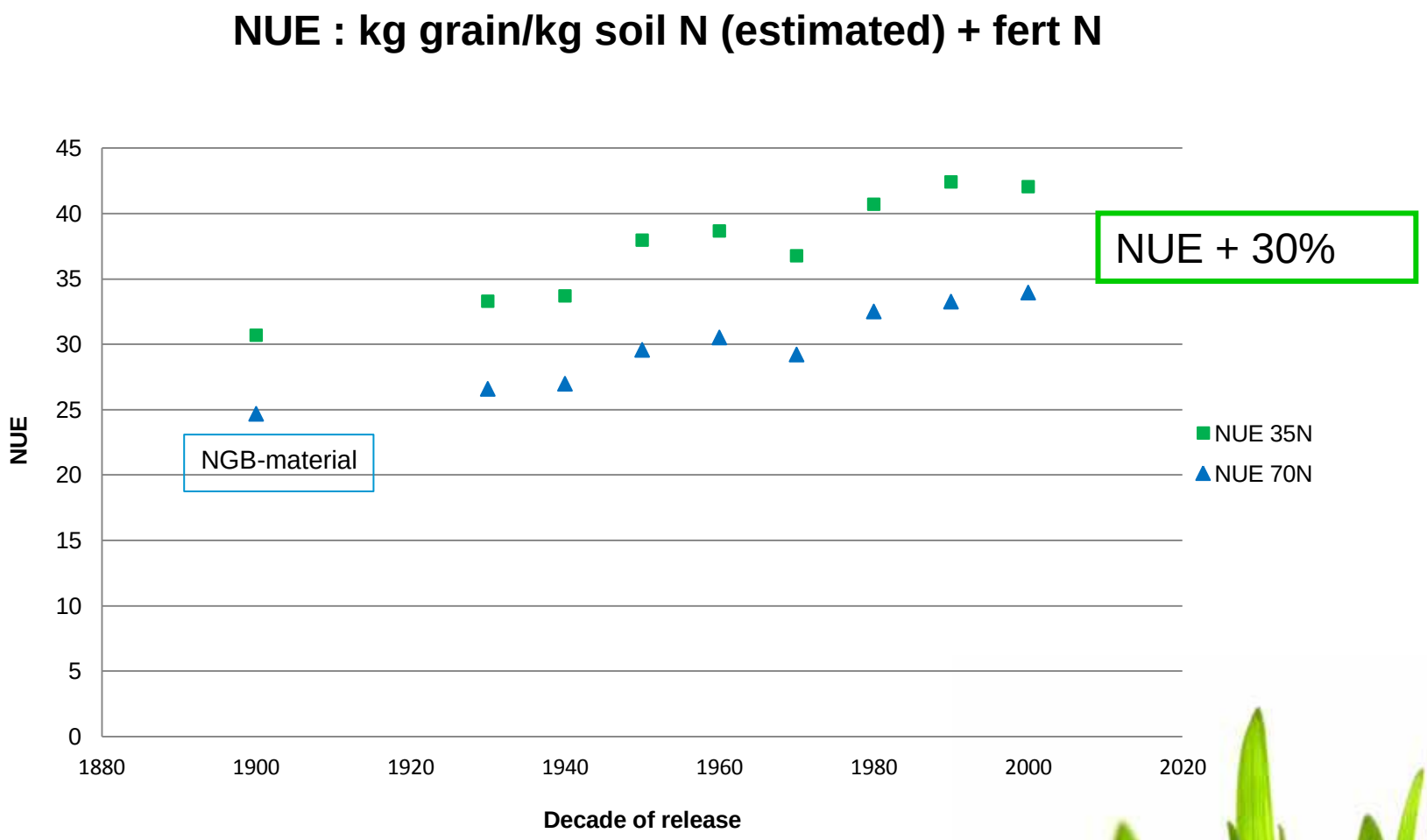


Fertilizer N use efficiency: 2011+12

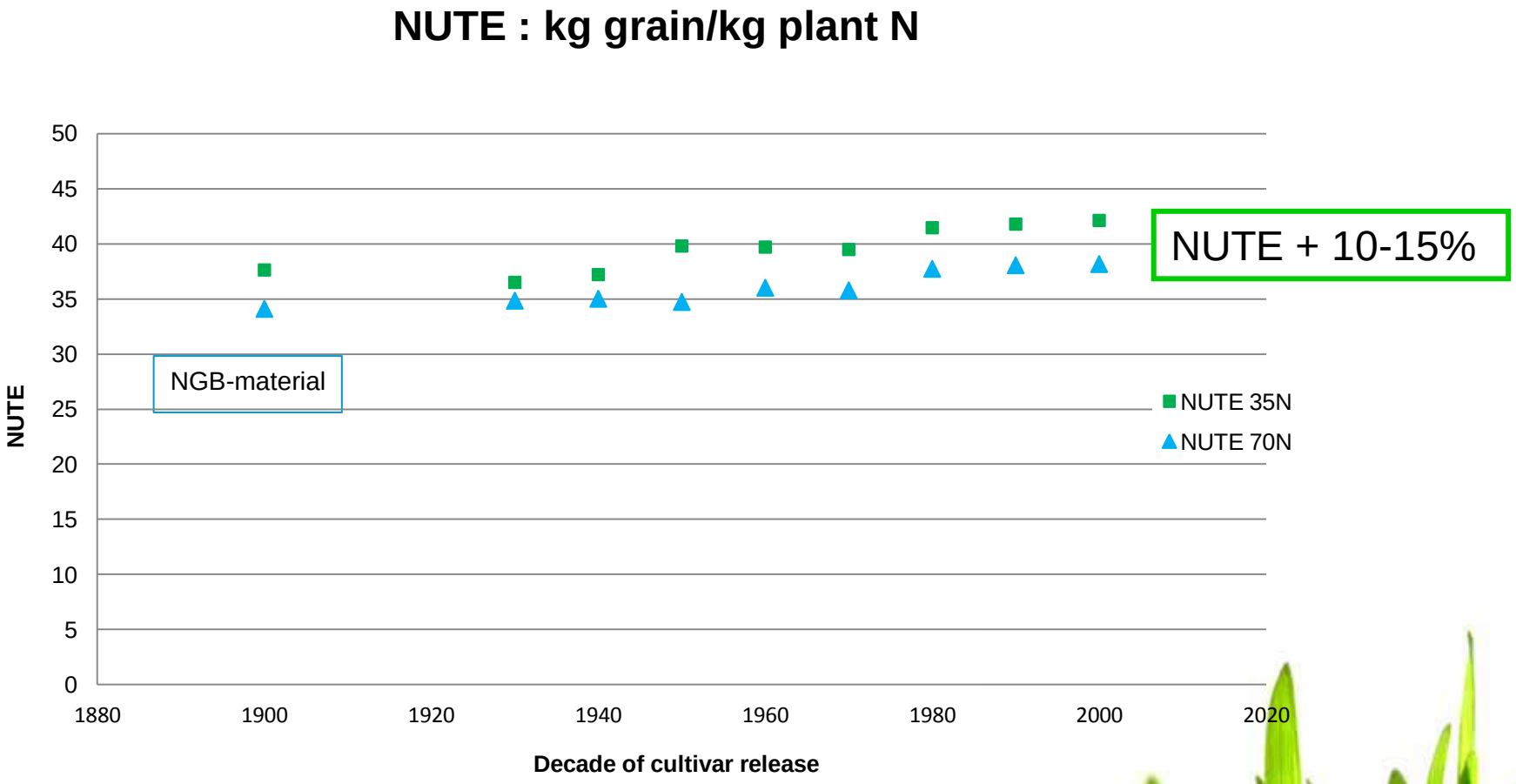


N use efficiency 2011

soil N = mean plant N uptake in unfertilized plots

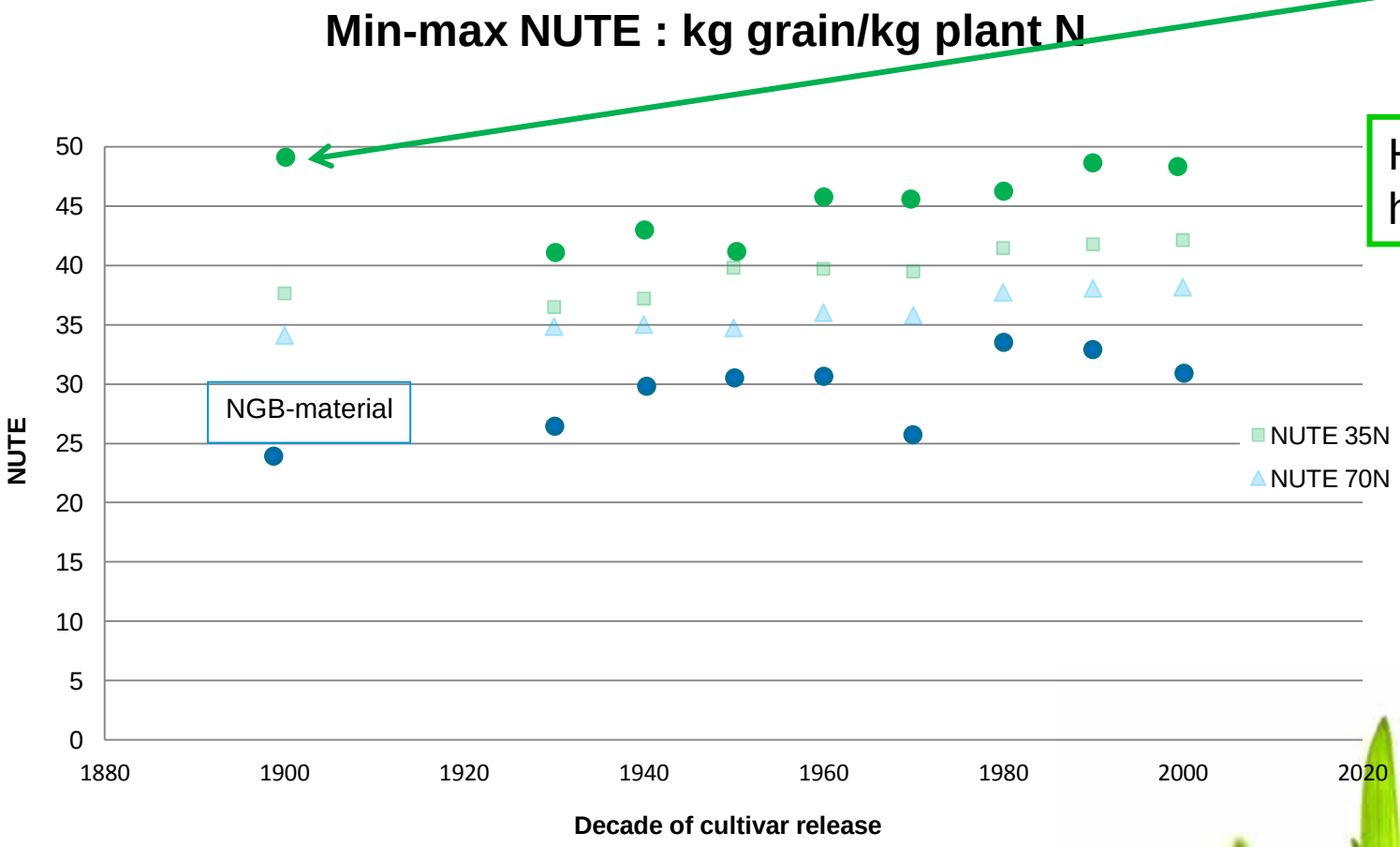


N utilization efficiency NUTE: 2011



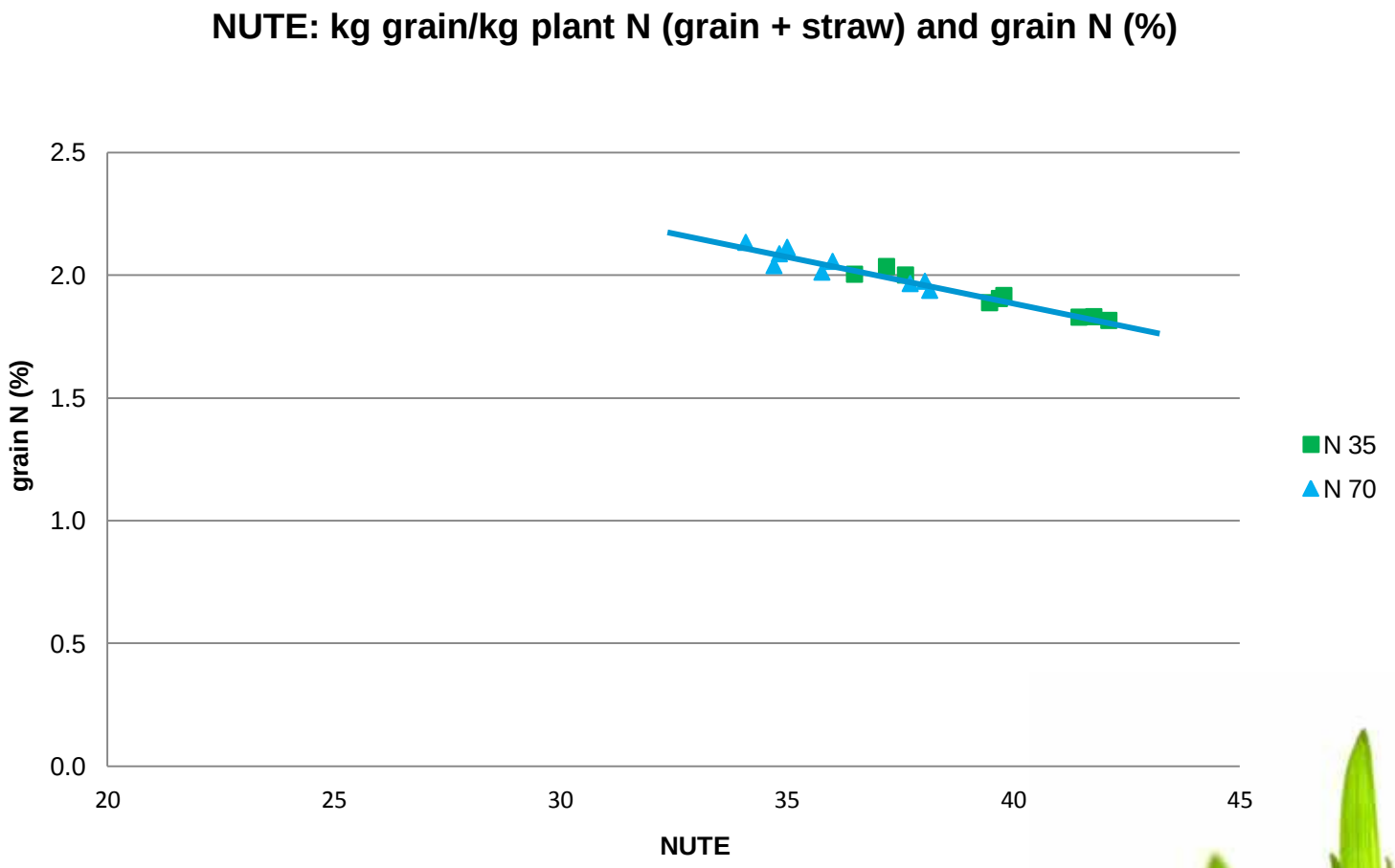
Min-max NUTE: 2011

Some of the NGB genotypes in top NUTE-ranking



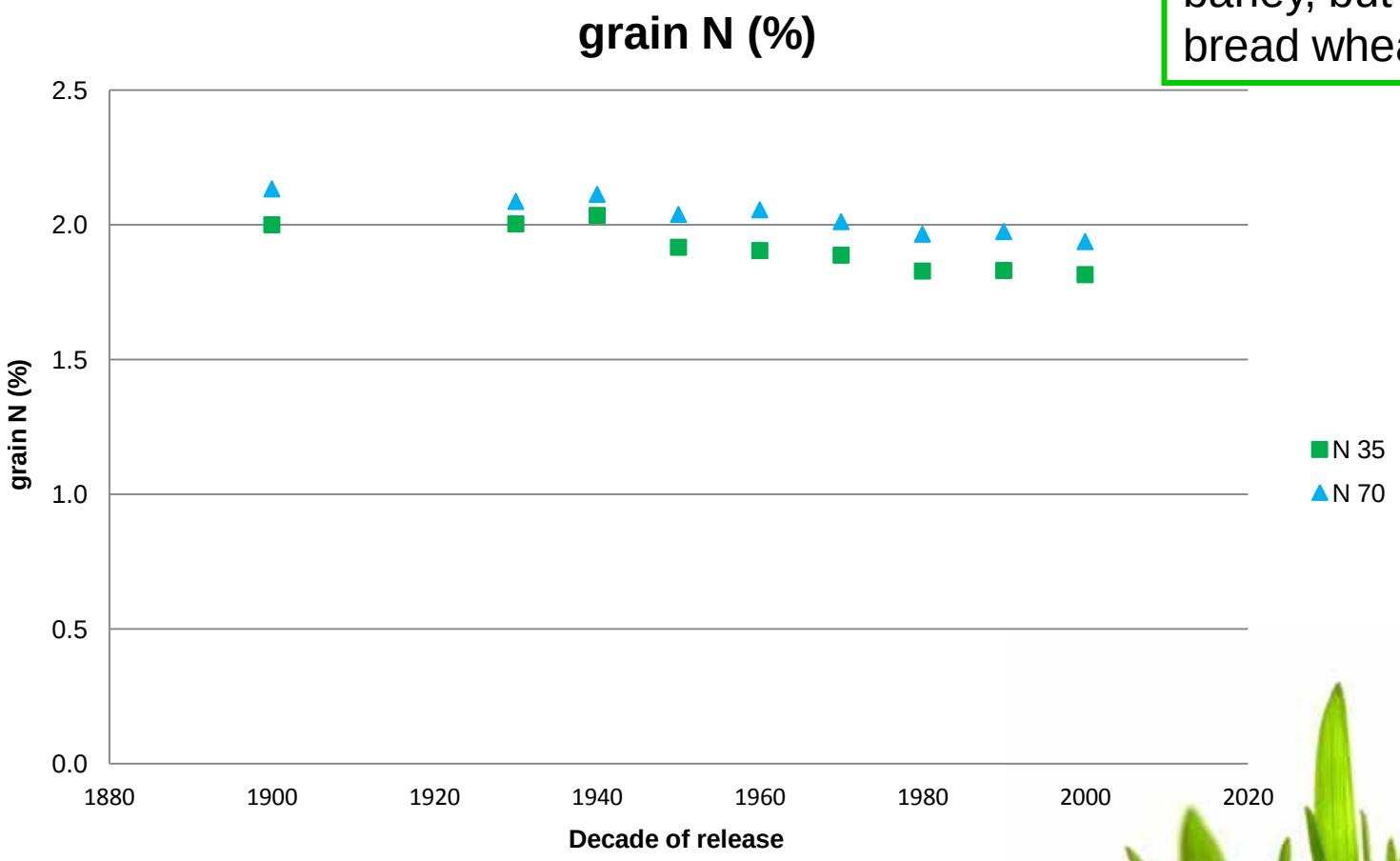
High NUTE has a price!

NUTE and grain N: 2011



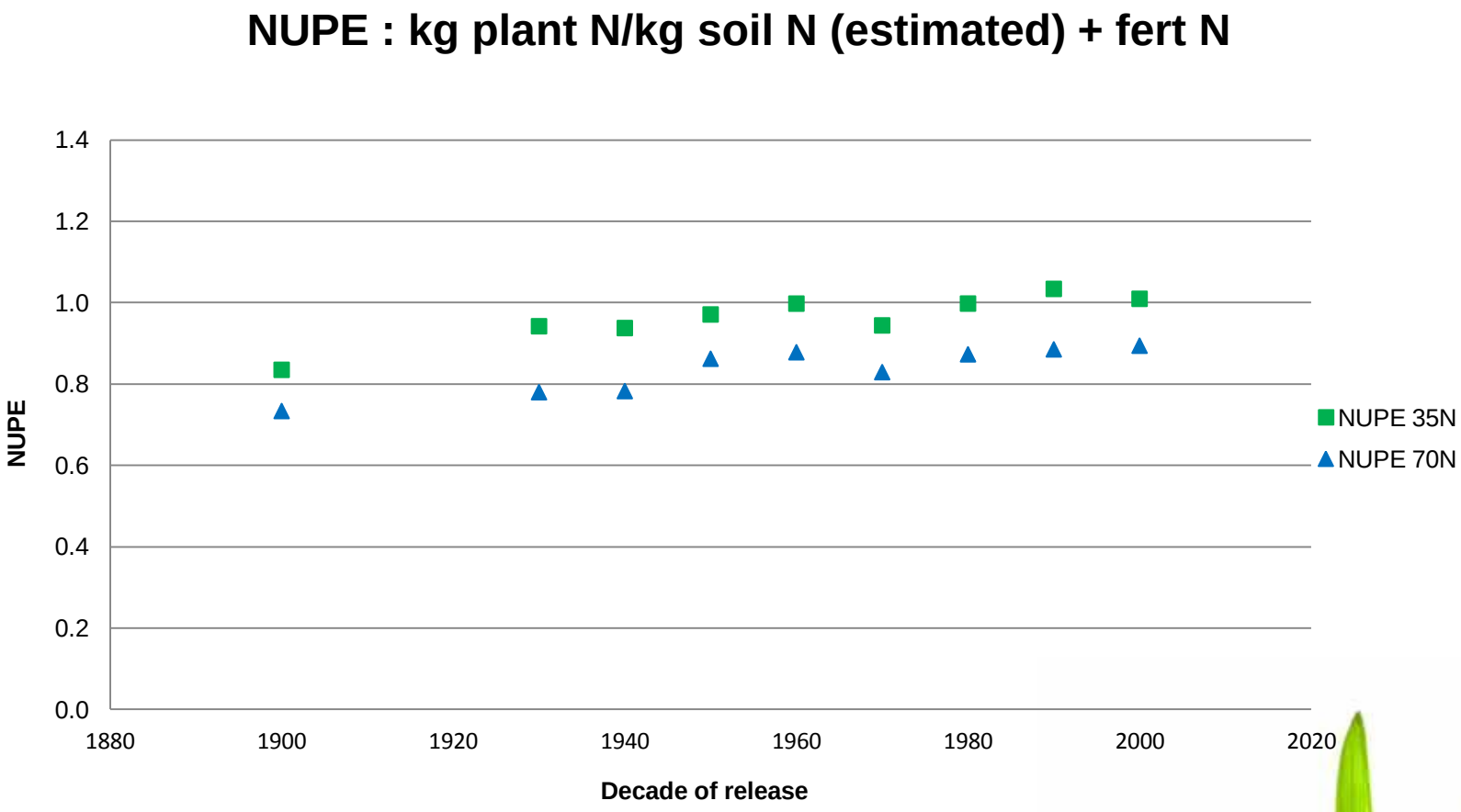
Grain N (%): 2011

Not a major concern in barley, but in bread wheat, yes

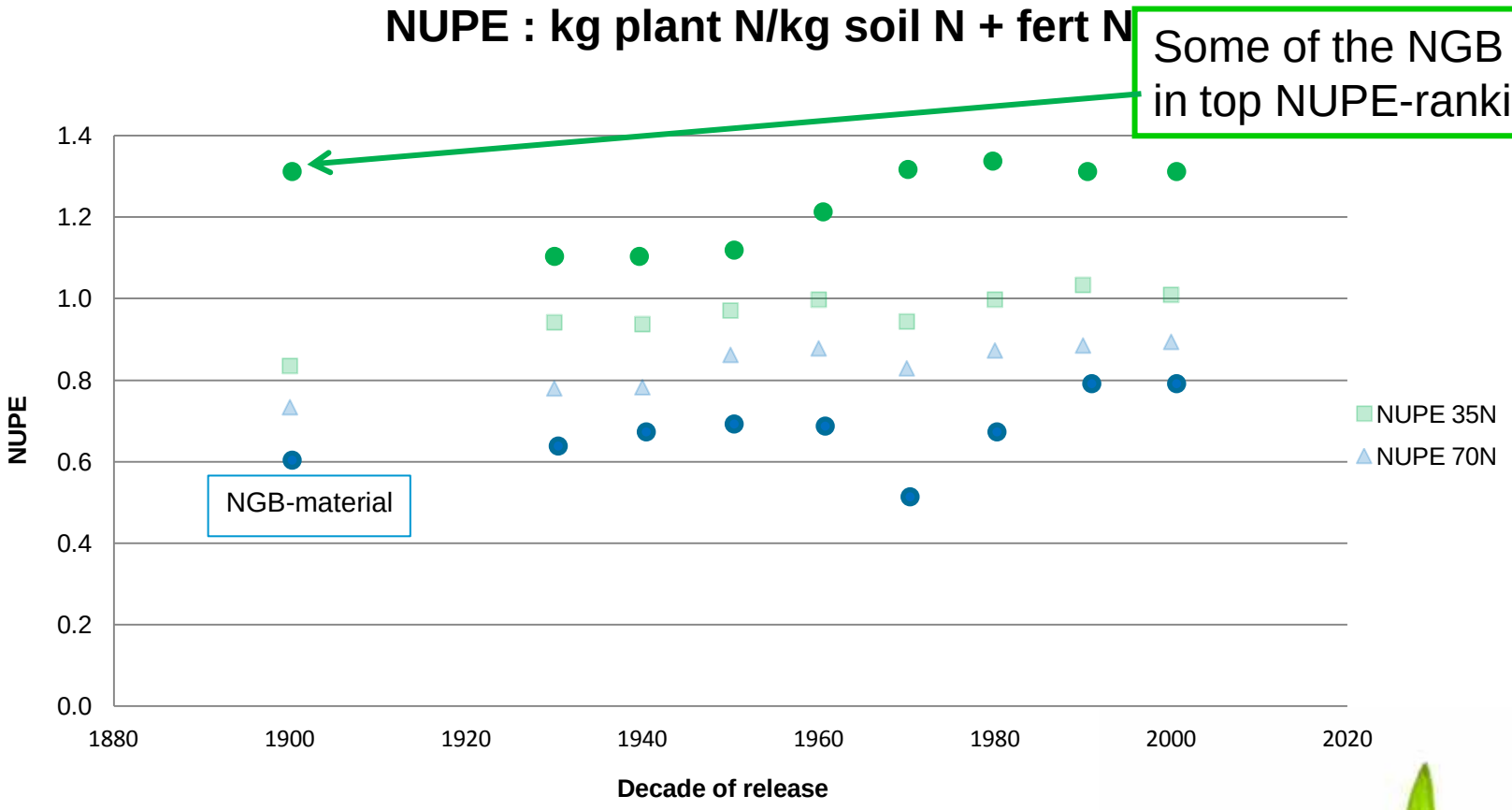


NUPE: 2011

soil N = mean plant N uptake in unfertilized plots

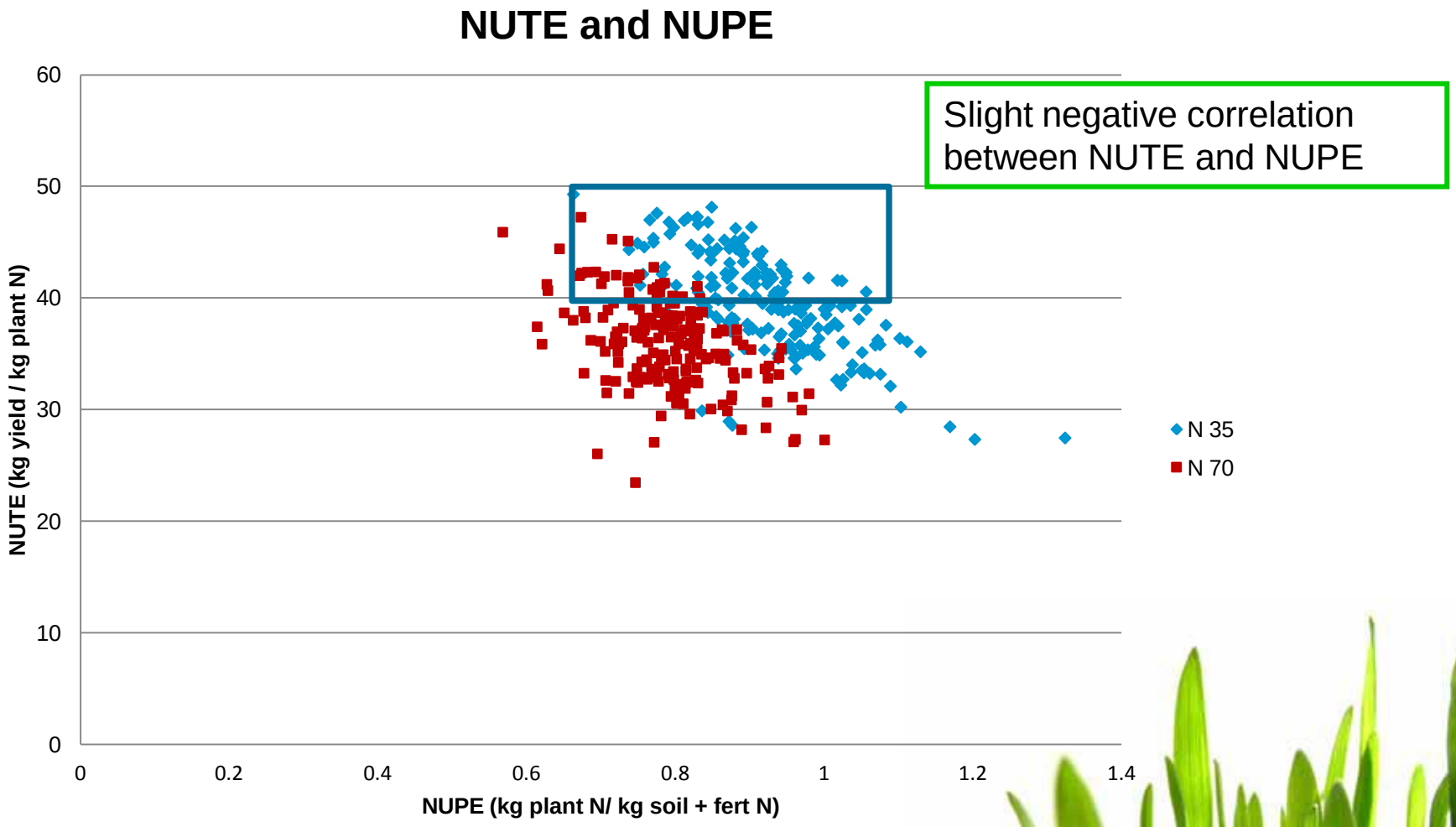


Min-max NUPE: 2011



NUPE and NUTE 2011

NUTE (kg yield/kg plant N) ja NUPE (kg plant N/kg soil + fert N)



Conclusions

- Breeding has greatly improved agronomic traits and yielding capacity
- Modern cultivars outperformed the land races in N use efficiency
- However, some of the landraces had high N utilization or uptake efficiency → potential crossing material for breeding programmes
- Some DNA-markers (SNP) associated with N use efficiency indices. These markers may fasten the backcrossing process in plant breeding

Acknowledgements

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Thank you!