Evaluation of mini-cuttings as a propagation system for *Eucalyptus* hybrids

IPPS 18th Annual Conference, Saint Ives

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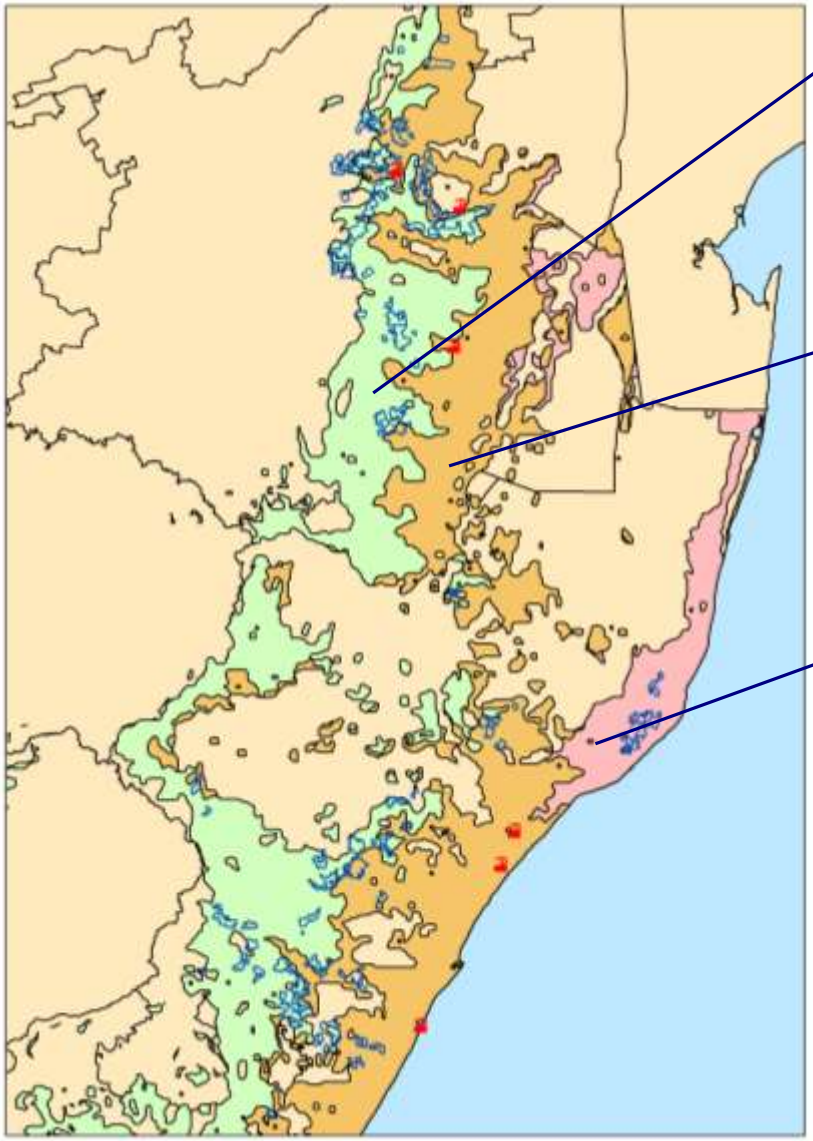
Introduction to Sappi



Cool Temperate
Inland plateau areas
with cold dry winters
frost on whole landscape
risk of snow damage

Warm Temperate
Escarpment areas with
cooler dry winters
frost on lower slopes and drought
risk with shallow soils & low rainfall

Subtropical
Coastal areas with
year-round growing environment
limited only by dry winters

Introduction

- Clonal propagation is an efficient technique to capture genetic gain.
- The inability to root is often a constraint to the deployment of some clones.
- Three factors are crucial in the rooting success of *Eucalyptus*:
  - Condition of the mother plant
  - Rooting environment conditions
  - Genetic disposition

Source: Stape *et al* (2001); de Assis *et al* (2004); Titon *et al* (2006)

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Introduction

- Conventional vegetative propagation = macro-cutting
  - Hedges in the ground, widely-spaced (clonebank)
  - Semi-lignified coppice harvested
  - Cuttings set (8 to 10 cm)
- Limitations of this approach:
  - Controlling hedge nutrition
  - Climatic extremes
  - Maintaining juvenility




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Introduction

- Mini-cuttings
  - Mini-hedges in sand beds under cover (closely-spaced)
  - Herbaceous coppice harvested
  - Daily irrigation & nutrient supply
  - Smaller cuttings (4 to 7 cm)
- Expected outcomes of this approach:
  - Good hedge nutrition – better rooting
  - Hedges sheltered from climatic extremes
  - Cuttings retain their juvenility

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Aims and objectives

- To measure hedge productivity
- To compare rooting from mini-hedges with macro-hedges
- To compare plant quality and field survival

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Materials and methods

- Six clones spanning three taxa planted into sand beds
  - Temperate hybrids (alternative to *E. nitens*)
  - Sub-tropical (alternative to *E. grandis*)
- A layer of stone was first placed in the bed followed by washed, sieved river sand
- Hedges were planted at approximately 10 cm x 15 cm and irrigated using drippers

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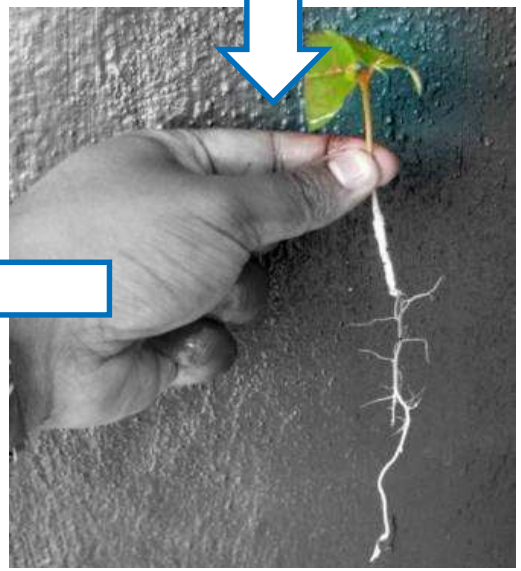
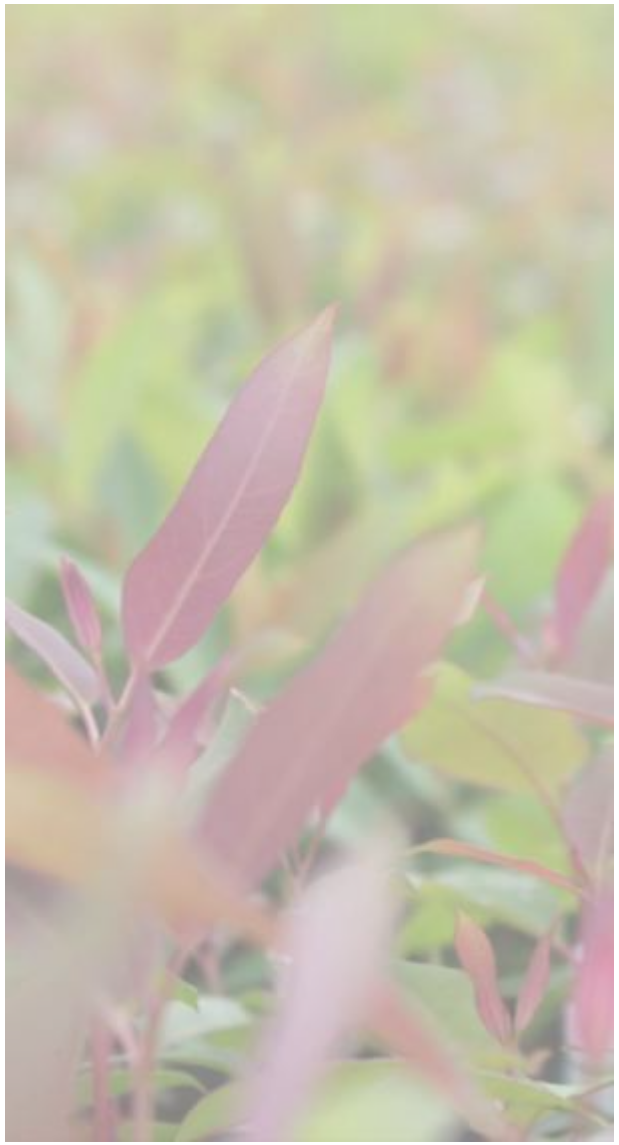
Materials and methods





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Trial analysis

- The trial was designed and analysed as per the following model:

$$y_{ijk} = u + taxa_i + propagation\ system_j + (taxa * propagation\ system)_{ij} + \varepsilon_{ijk}$$

Where:

- **y** = parameter of interest (productivity, rooting, plant quality, field survival)
- **μ** = overall mean
- **taxa$_i$** = fixed taxa effect (n = 3)
- **propagation system$_j$** = fixed propagation effect (macro or mini)
- **Taxa * propagation system** = factor interaction
- **ε** = random error associated with the ith taxon, the jth propagation system and the kth plant

- Data collected over a period of 3 years.

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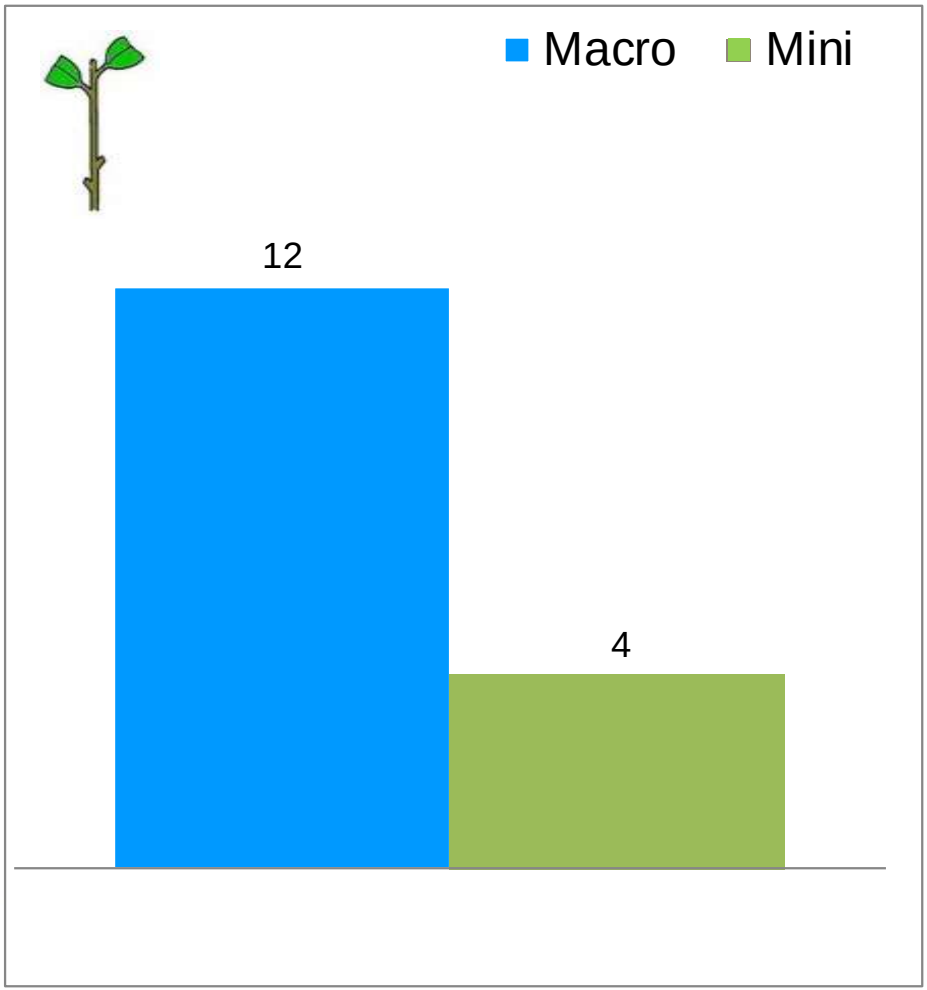
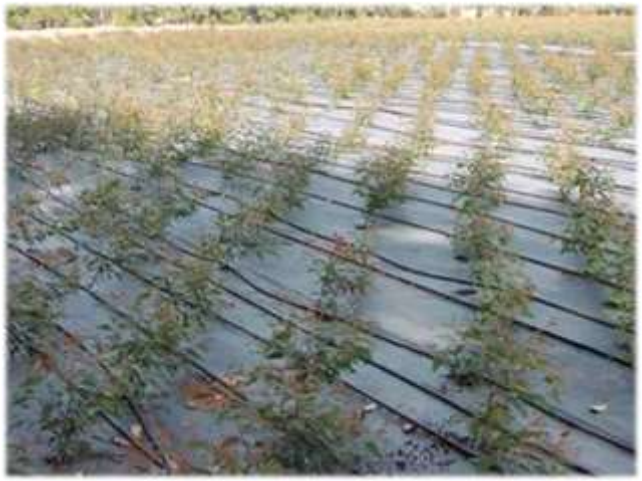
Results – GU hedge productivity

Number of cuttings per hedge per harvest



GU = *E. grandis x E. urophylla*



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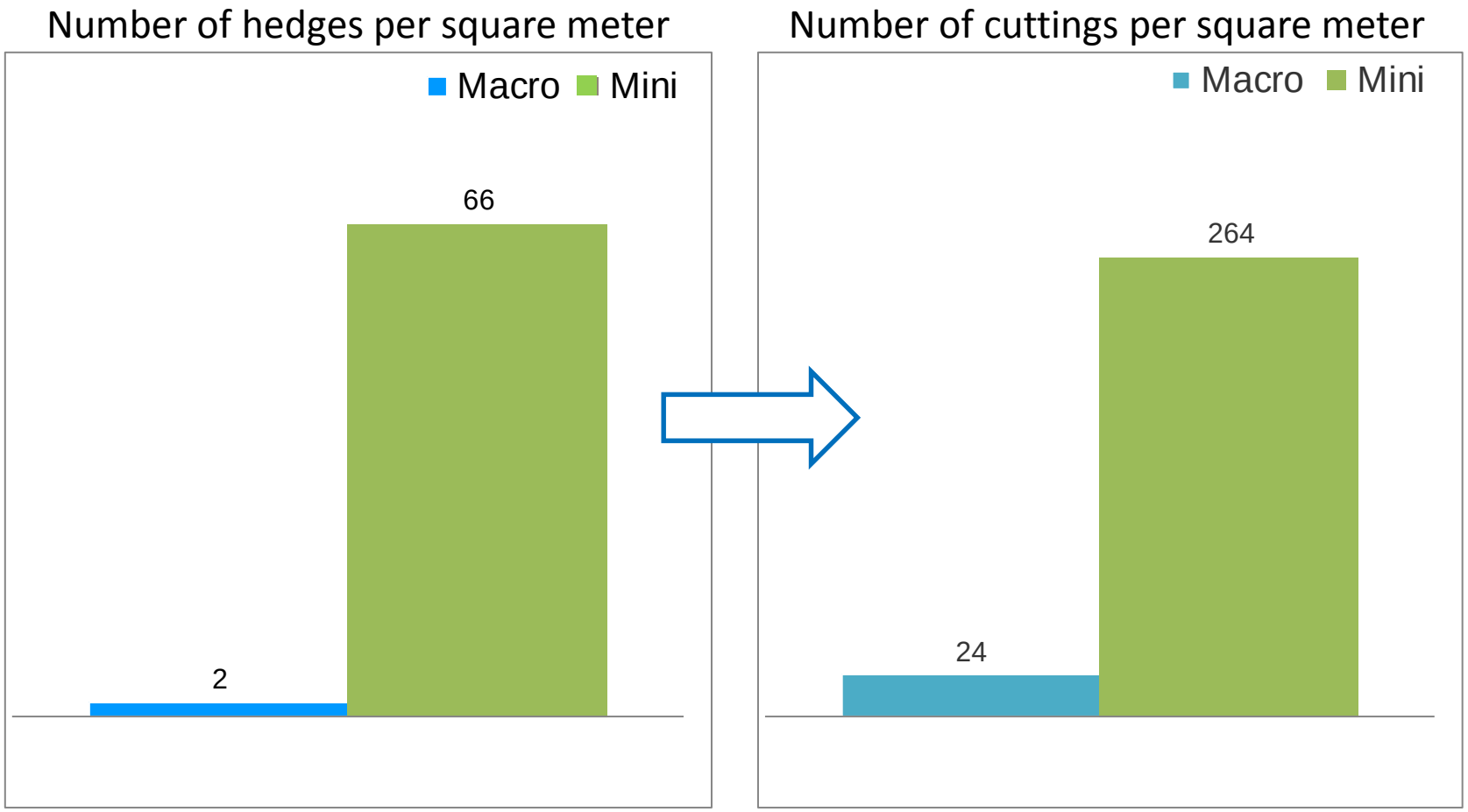
Results – GU hedge productivity

Macro-hedge spacing = 0.6 m x 0.8 m

Mini-hedge spacing = 0.10 m x 0.15 m



Mini hedges offer an 11 fold increase in cuttings/m²

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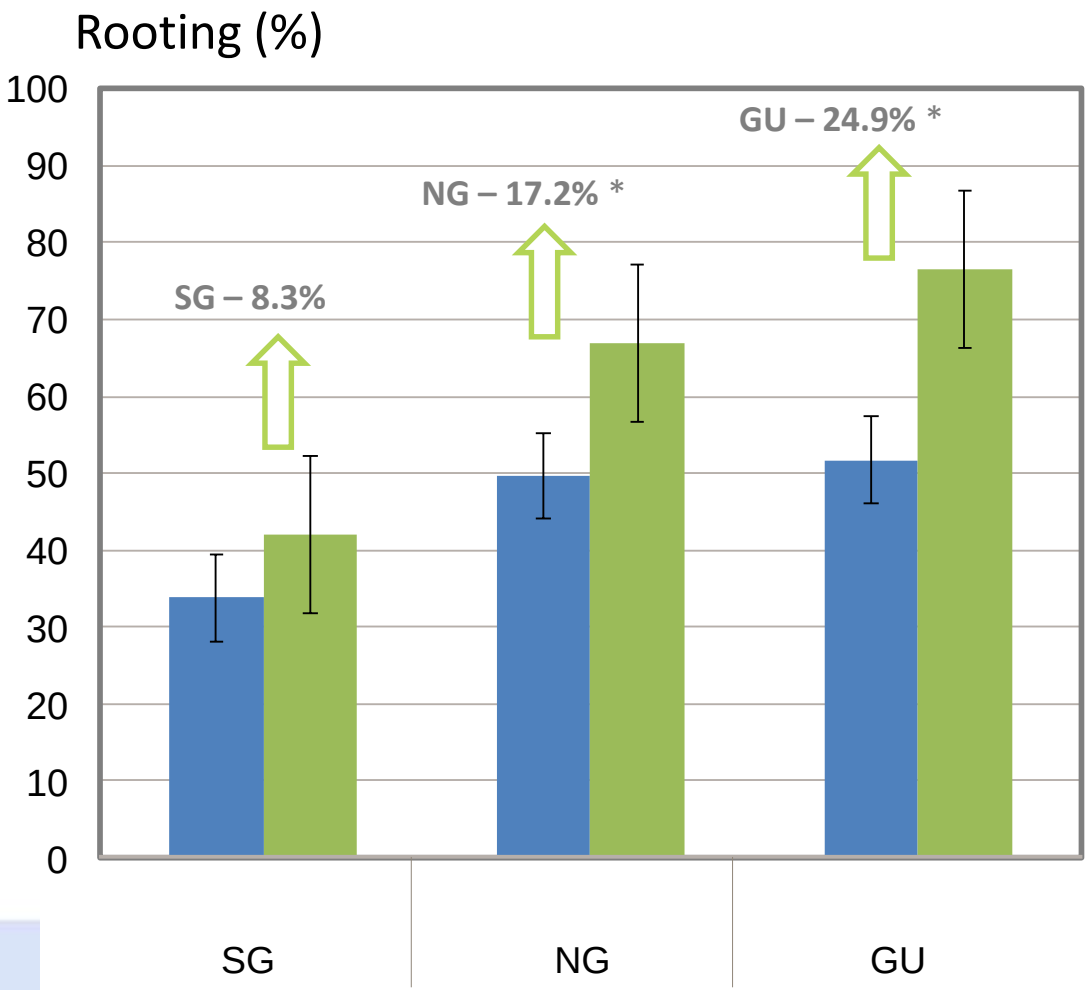
Results – Rooting



Macro

Mini

* = significant ($p<0.05$)

SG = *E. smithii* x *E. grandis*
NG = *E. nitens* x *E. grandis*
GU = *E. grandis* x *E. urophylla*

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Results – GU root quality at 6 weeks

- Cumulative root length (mm)
  - Macro = 20
  - Mini = 246
- Root dry mass (mg)
  - Macro ≈ 0
  - Mini = 55
- Shoot dry mass (g)
  - Macro = 0.75
  - Mini = 1.00

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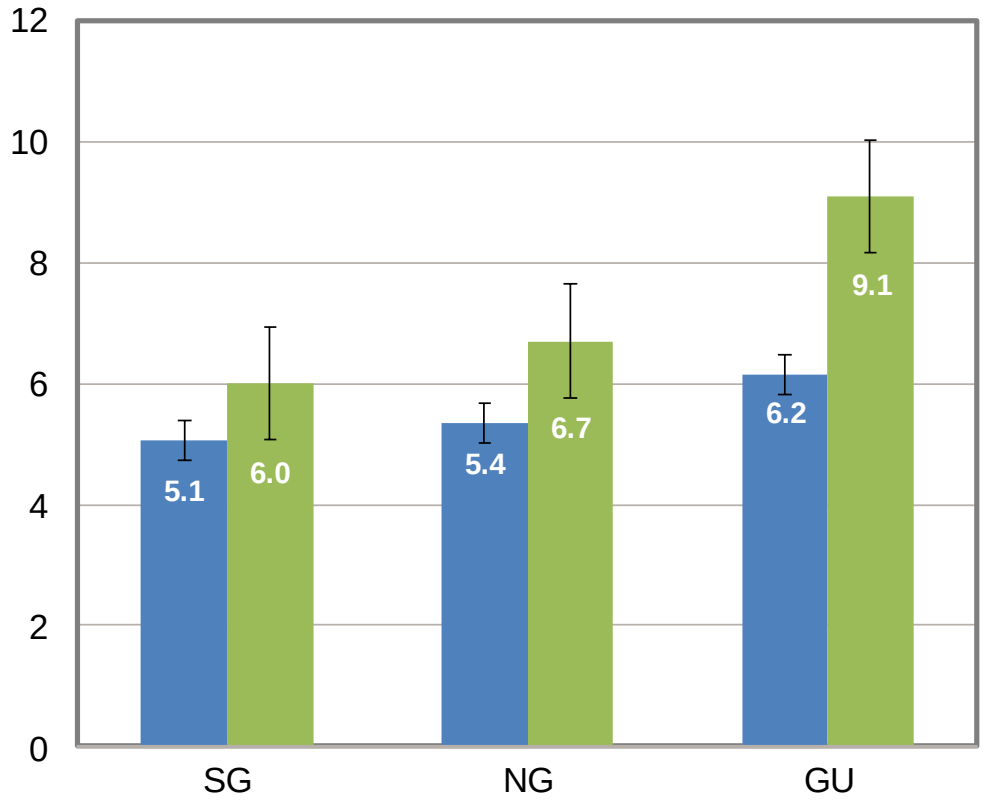
Results – Plant quality at 12 weeks

New shoot height (cm)



Macro

Mini

Greatest gains for GU
Only SG not significant

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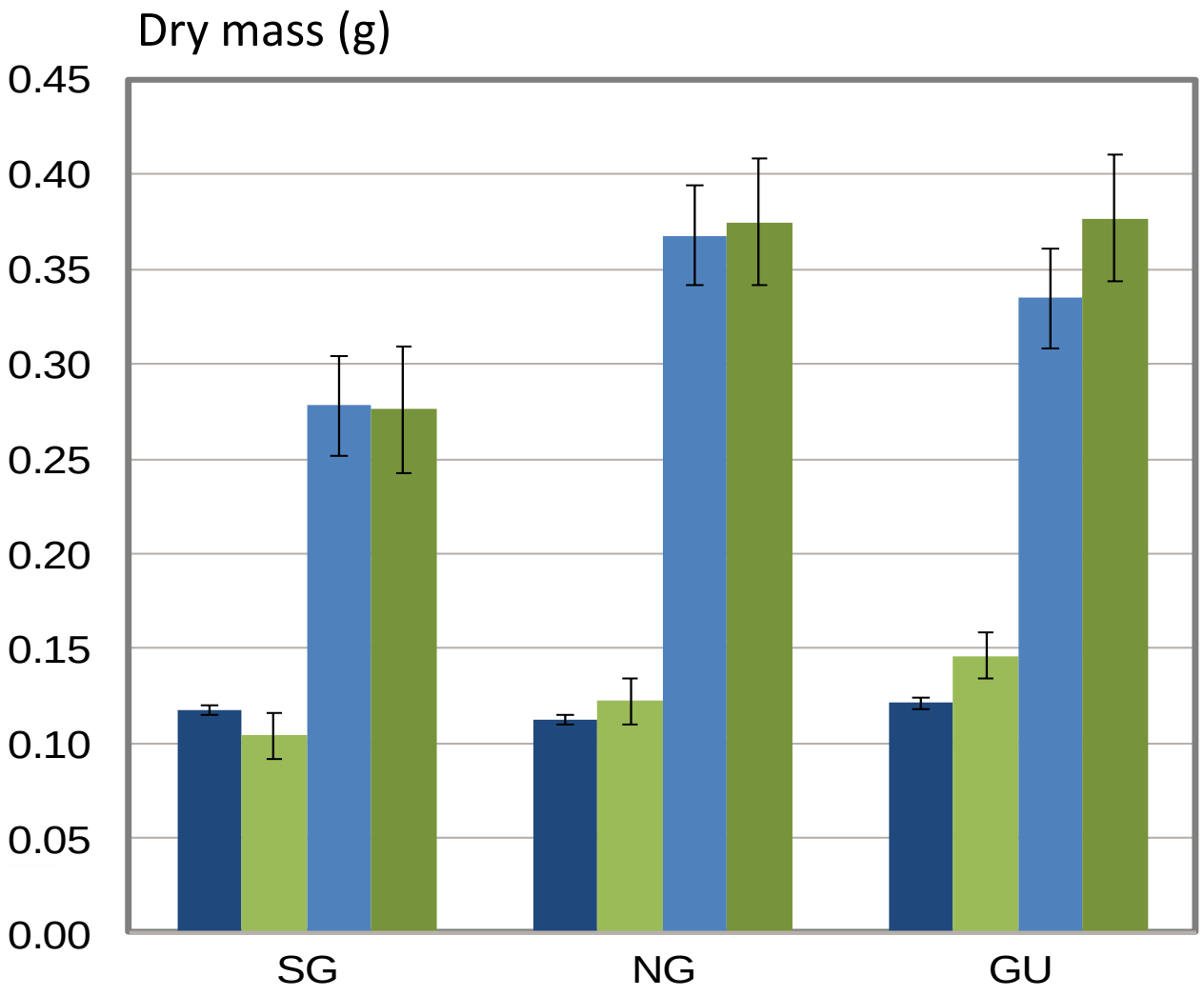
Results – Plant quality at 12 weeks



Mini-cuttings yield similar or greater dry mass with exception of SG

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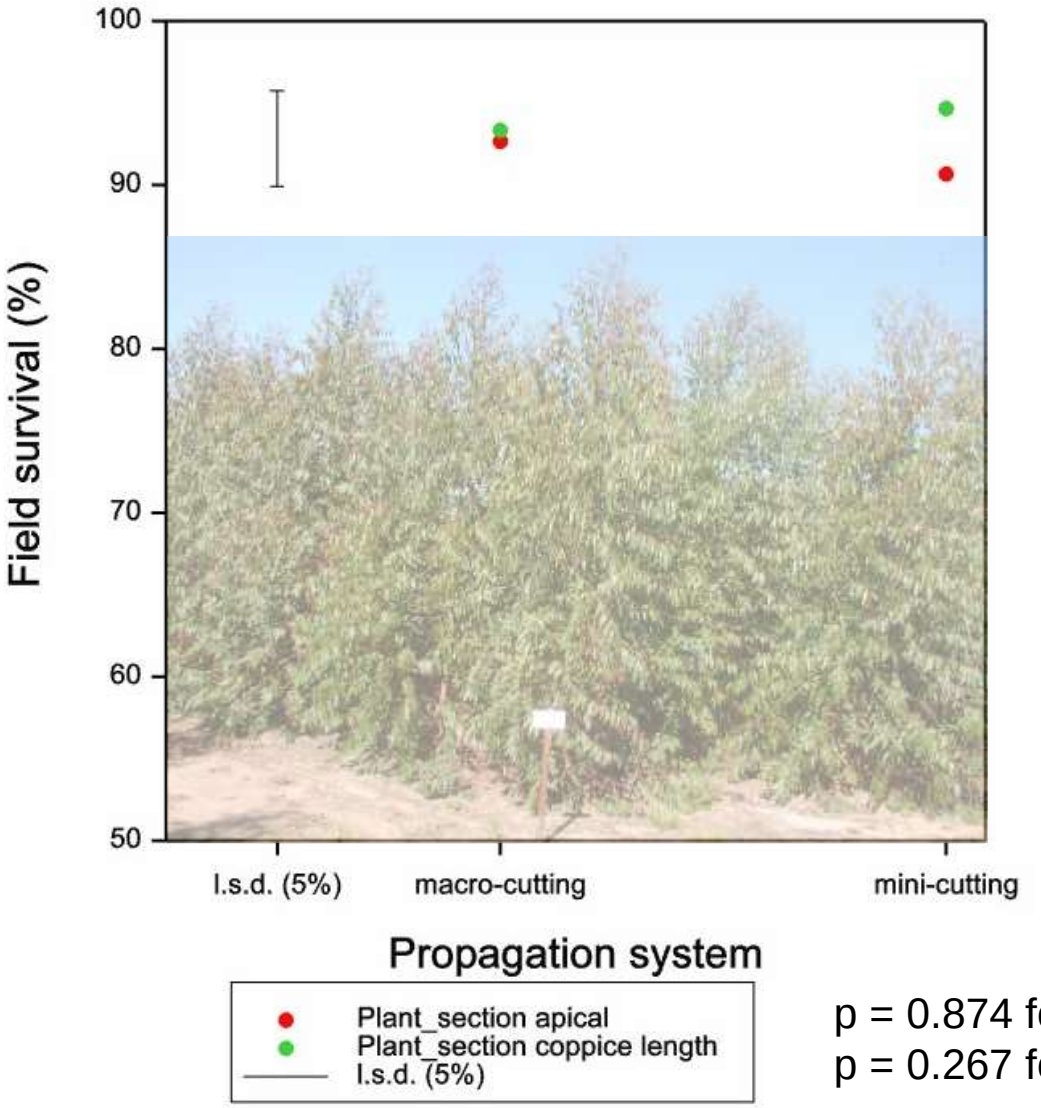
Results – One year field survival for a GU clone



p = 0.874 for propagation system
p = 0.267 for plant section

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Summary

- Mini-cuttings offers many benefits:
  - More juvenile, herbaceous cuttings.
  - Improved control over hedge environment.
  - Better productivity per square metre allows for intensive management over a small area.
  - The superior rooting success – better nursery efficiencies.
  - Higher quality root systems
  - Increased rooting speed – optimizing nursery capacity
  - Better plant quality = better initial field performance

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High quality,
genetically
improved
cuttings
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