



The Growth and Yield of Narrow-leafed Lupin: Myths and Realities

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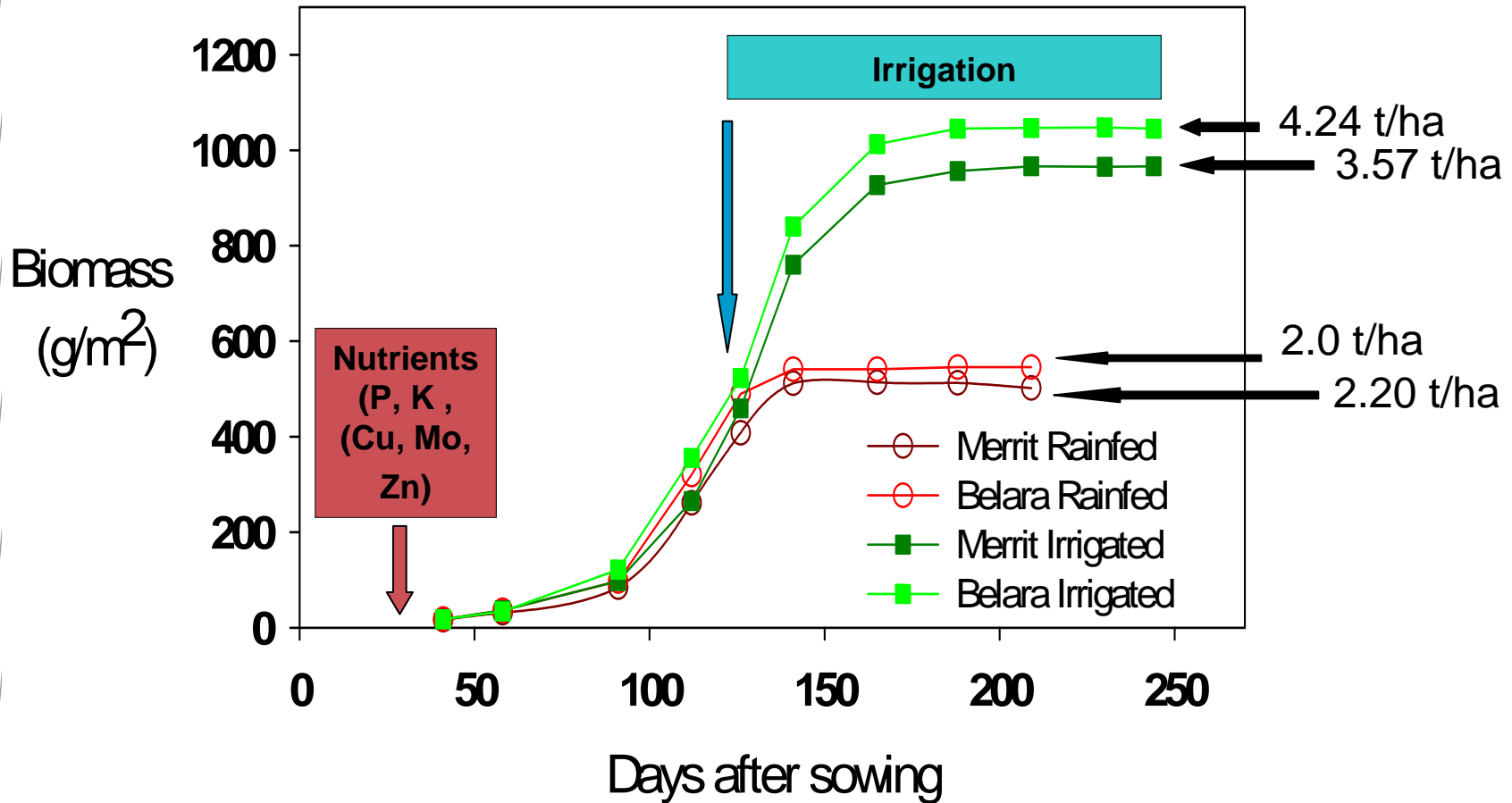
Introduction

- Narrow-leafed lupin (*Lupin angustifolius* L.) is the most important grain legume crop in Australia.
- It is also a vital component of the sustainable farming system of the Mediterranean climatic region of Australia
- With the increasing cost of energy, and therefore fertiliser N, lupin is expected to have an increasing value in the farming system.

The indeterminate growth habit myth

- Crop adoption to new areas in Western Australia, particularly high rainfall southern areas, has been limited by prevailing myths on its growth and yield
- One of these believes is that **under abundance of soil water and nutrients, narrow-leafed lupin will grow continuous like trees, producing few pods only.**

Lupin growth under supplementary irrigation (2003) (291 mm)



Lupin yield under high rainfall and soil fertility 2006 -2007 (687 mm)

Treatments	Biomass (t/ha)	Grain yield (t/ha)	Harvest Index (%)
Control	25.4	12.4	0.49
Shading 1	29.3	14.2	0.48
Shading 2	27.6	12.0	0.43
Shading 3	24.2	10.5	0.44
Shading 4	24.1	10.5	0.44
Shading 5	28.0	13.2	0.47
Shading 6	29.7	14.0	0.47

Sandaña *et al.*, (2008) Field Crops Research

Lupin yield under high rainfall and soil fertility 2007 -2008 (502 mm)

Treatments	Biomass (t/ha)	Grain yield (t/ha)	Harvest Index (%)
Control	25.3	12.2	0.48
Shading 1	17.3	8.5	0.49
Shading 2	20.5	9.6	0.47
Shading 3	22.0	9.2	0.42
Shading 4	15.4	6.3	0.41
Shading 5	21.2	10.2	0.48
Shading 6	22.8	11.2	0.49

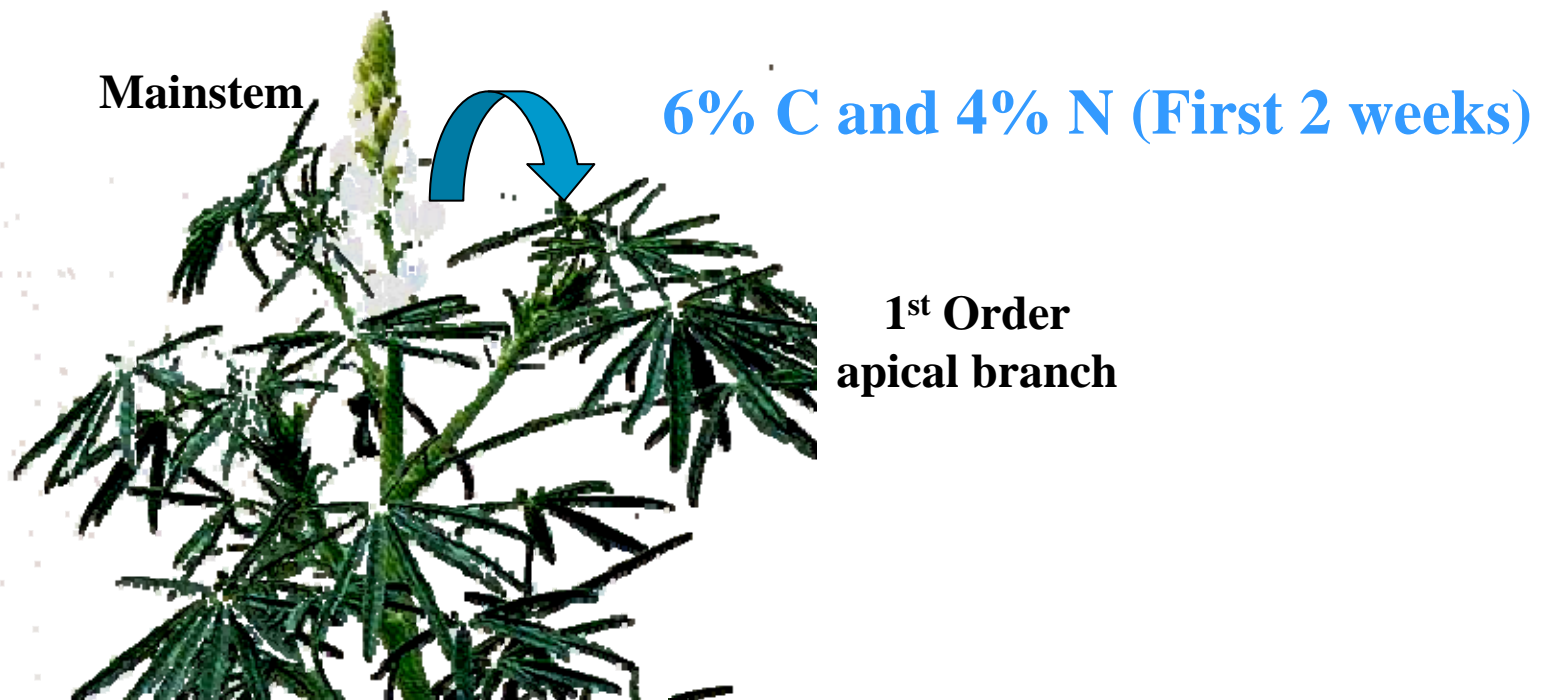
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The restricted branching myth

- Narrow-leaved lupin produces large biomass on the branches.
- It is believed that the large branch biomass reduces total yield by reducing the productivity of the mainstem
- The misconception here is that mainstem yield is the principal source of plant yield and that branches compete with the mainstem for resources.

The use of ^{13}C and ^{15}N

- Competition for resources between branches and mainstem **is not strong and continuous** through the development of apical branches



The use of ^{13}C and ^{15}N

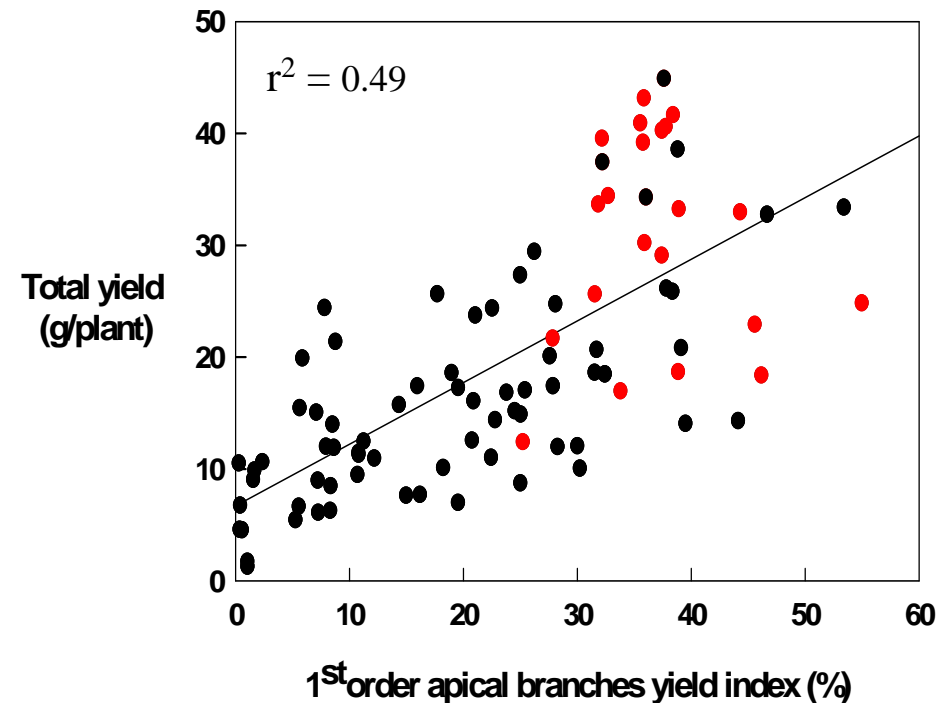
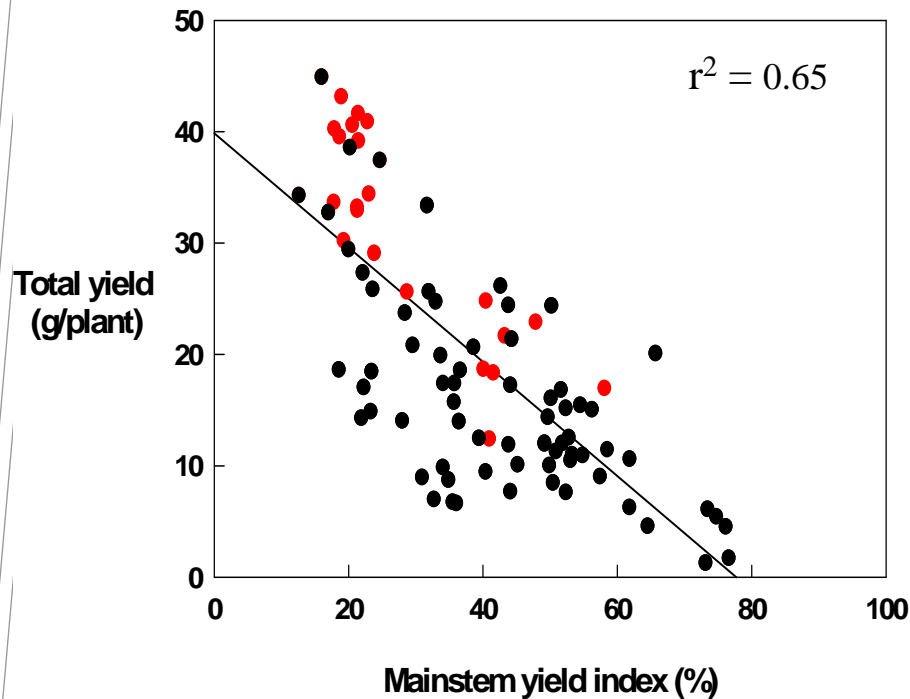
- Consequently, there is ***no*** C and N contribution from mainstem to grain production in any of the lateral branch orders

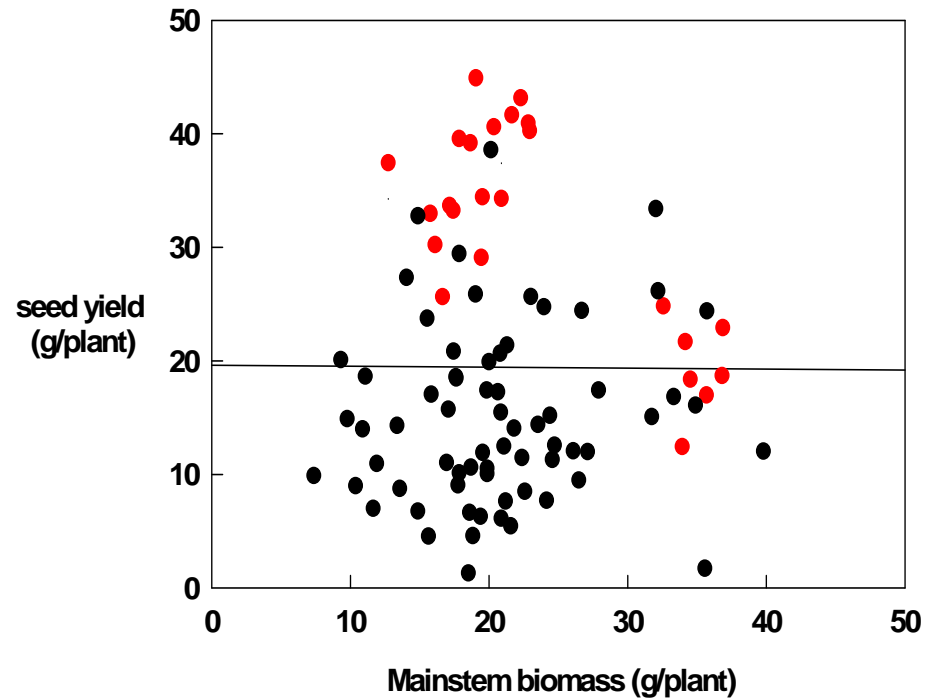
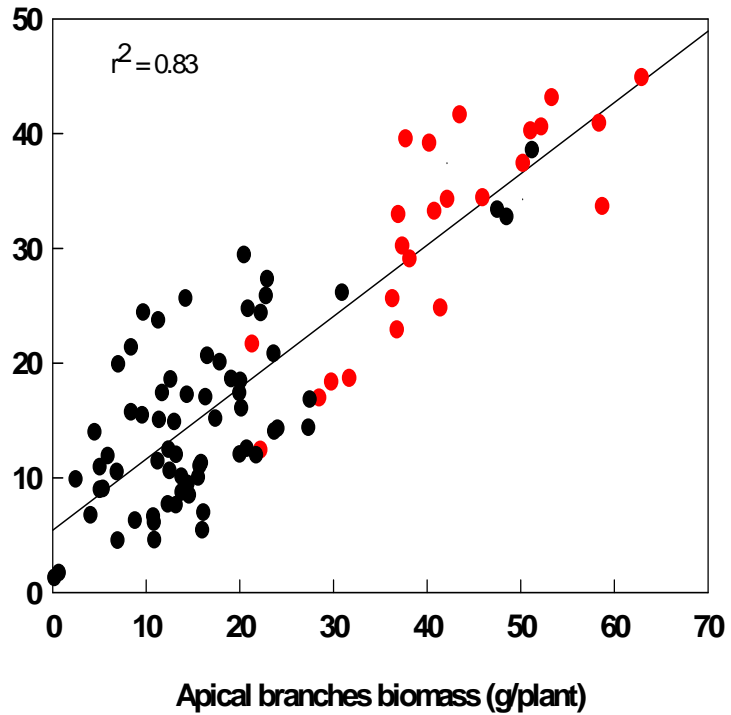


Evaluation of a breeders core collection for competition between mainstem and branch yield

27 Cultivars released from 1967-2004

67 wild genotypes collected from 11 countries





The realities

1. Pre-anthesis growth of narrow-leaved lupin is slow



62%

72-80%



51%

55-60%

5.0 - 6.5 g C to
fix 1 g of N

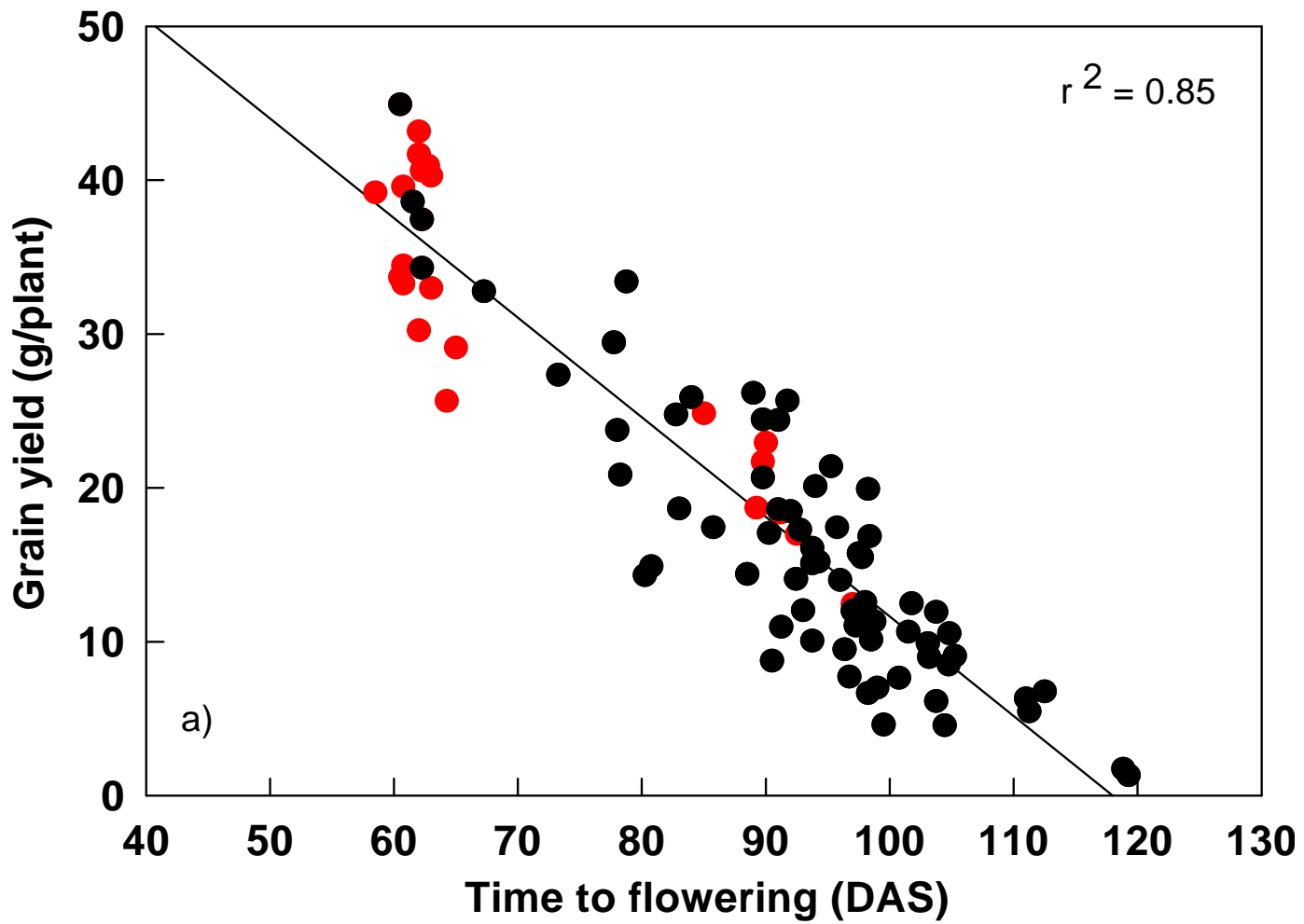
Improving pre-anthesis growth

- Selecting lupin cultivars with vigorous seedling growth
- Consideration should be taken to prevent a reduction in the fixing N capacity of narrow-leaved lupin while improving early growth.

Another reality

2. Sensitivity to terminal drought.

- C assimilation in narrow-leafed lupin is very sensitive to water deficit
- This sensitivity causes the end of vegetative and reproductive growth
- Varietal selection has ensured early flowering in narrow-leafed lupin



- Drought escape is characteristic of modern lupin cultivars with early flowering and high rates of seed filling
- Drought escape may limit yield improvement because yield in lupin is resource limited.
- Finishing the growing season early limits the time available for biomass accumulation.
- Generate a tension between drought escape and maximising resource availability

CONCLUSIONS

- Under abundance of soil water and nutrients the indeterminate growth habit of narrow-leaved lupin has an ending.
- The role of restricted branching on improving yield in lupin is questionable.
- Competition for resources between branches and mainstem yield is not strong and continuous to have a substantial effect on mainstem yield.

CONCLUSIONS

- The possible “trade offs” of improving early growth in lupin need to be evaluated.
- The drought escape trait may have some limitations for improving yield because yield in lupin is C limited

Thank you

