

Short-term carbon partitioning fertilizer responses vary among two full-sib loblolly pine clones



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Clonal Fertilizer Response



Hypotheses

- So how are clones responding to fert?
 - Photosynthesis..... Some clones (King et al. 2008)
 - Biomass partitioning..... (Stovall et al. 2011)
 - Respiratory C fluxes..... ?



Greenhouse Experiment

- Wakulla series (SETRES)
- 2 Clones w/ same parents
 - C 34: Narrow crown
 - C 769: Wide crown
- 2 Fertilizer levels
- 4 Monthly Harvests
- 8 Replications



Tree Physiology 29, 857–868
doi:10.1093/treephys/tpp030

The influence of N and P supply and genotype on carbon flux and partitioning in potted *Pinus radiata* plants

HORACIO E. BOWN,^{1,2} MICHAEL S. WATT,³ PETER W. CLINTON,³
EUAN G. MASON⁴ and DAVID WHITEHEAD⁵

Global Change Biology (2003) 9, 1438–1450

Primary production and carbon allocation in relation to nutrient supply in a tropical experimental forest

CHRISTIAN P. GIARDINA*, MICHAEL G. RYAN† ‡§, DAN BINKLEY‡§ and
JAMES H. FOWNES*

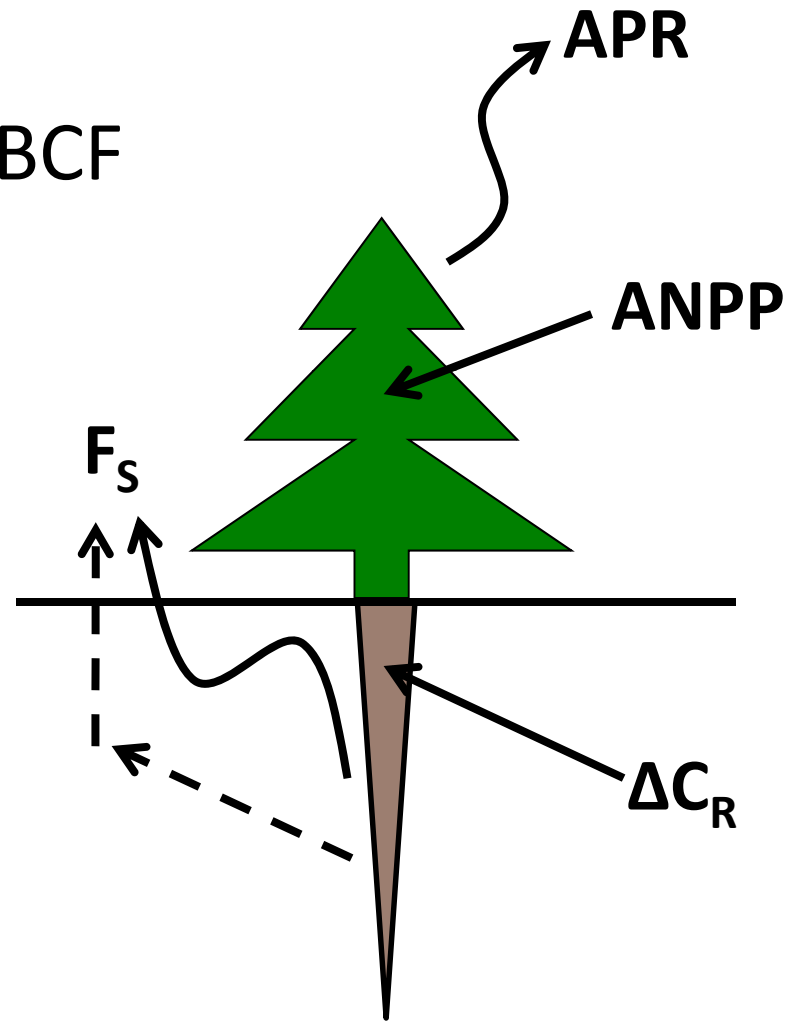
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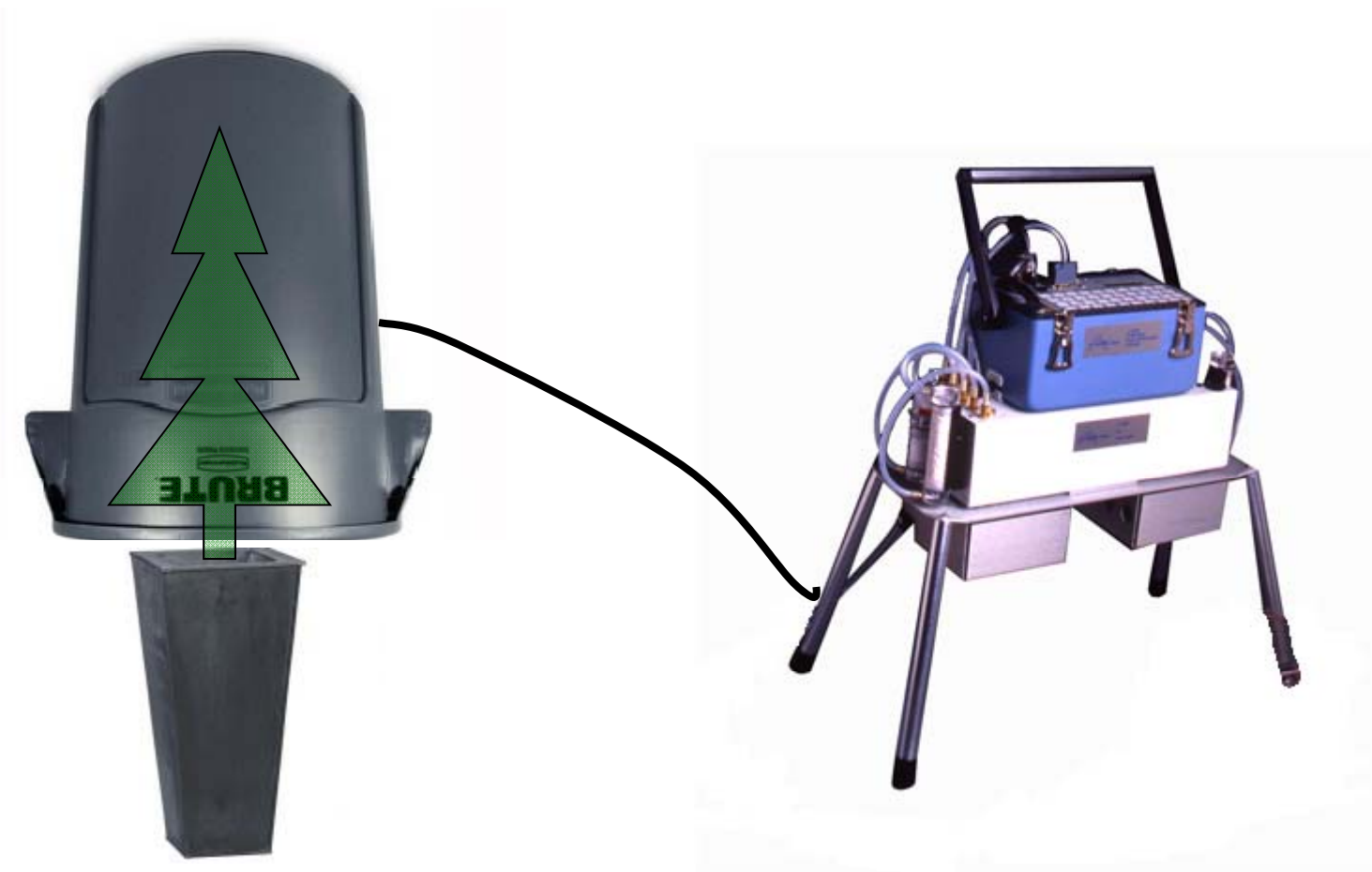
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C Budgeting Simplified

- $GPP = ANPP + APR + TBCF$
- $TBCF = F_S + \Delta C_R$



Measuring APR & F_s Directly



Quantifying ANPP & ΔC_R

Using Monthly Harvest Data
 biomass = a (basal diameter)^b (height)^c

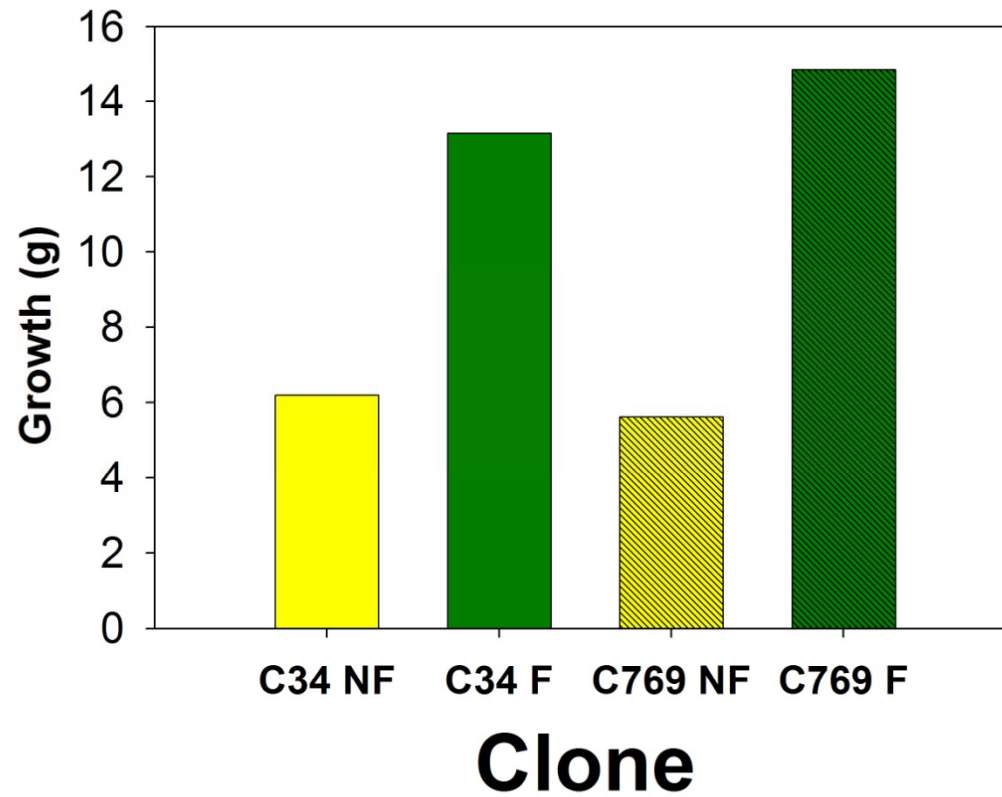
Aboveground Biomass								
Treatments		Coefficients			Statistics			
Clone	Fert	a	b	c	F	p-value	R ²	N
34	0	0.2920	1.1369	0.3848	476.51	<0.0001	0.980	32
34	1	0.1231	1.2144	0.5794	622.51	<0.0001	0.985	32
769	0	0.4868	1.2454	0.1919	856.21	<0.0001	0.989	32
769	1	0.0362	1.6936	0.6130	575.99	<0.0001	0.983	32

Belowground Biomass								
Treatments		Coefficients			Statistics			
Clone	Fert	a	b	c	F	p-value	R ²	N
34	0	0.3013	1.1540	0.1640	307.11	<0.0001	0.969	32
34	1	0.0434	2.1348	0.0833	254.35	<0.0001	0.963	32
769	0	0.0734	1.2373	0.5320	355.50	<0.0001	0.974	32
769	1	0.1332	2.2059	-0.1686	295.06	<0.0001	0.968	32

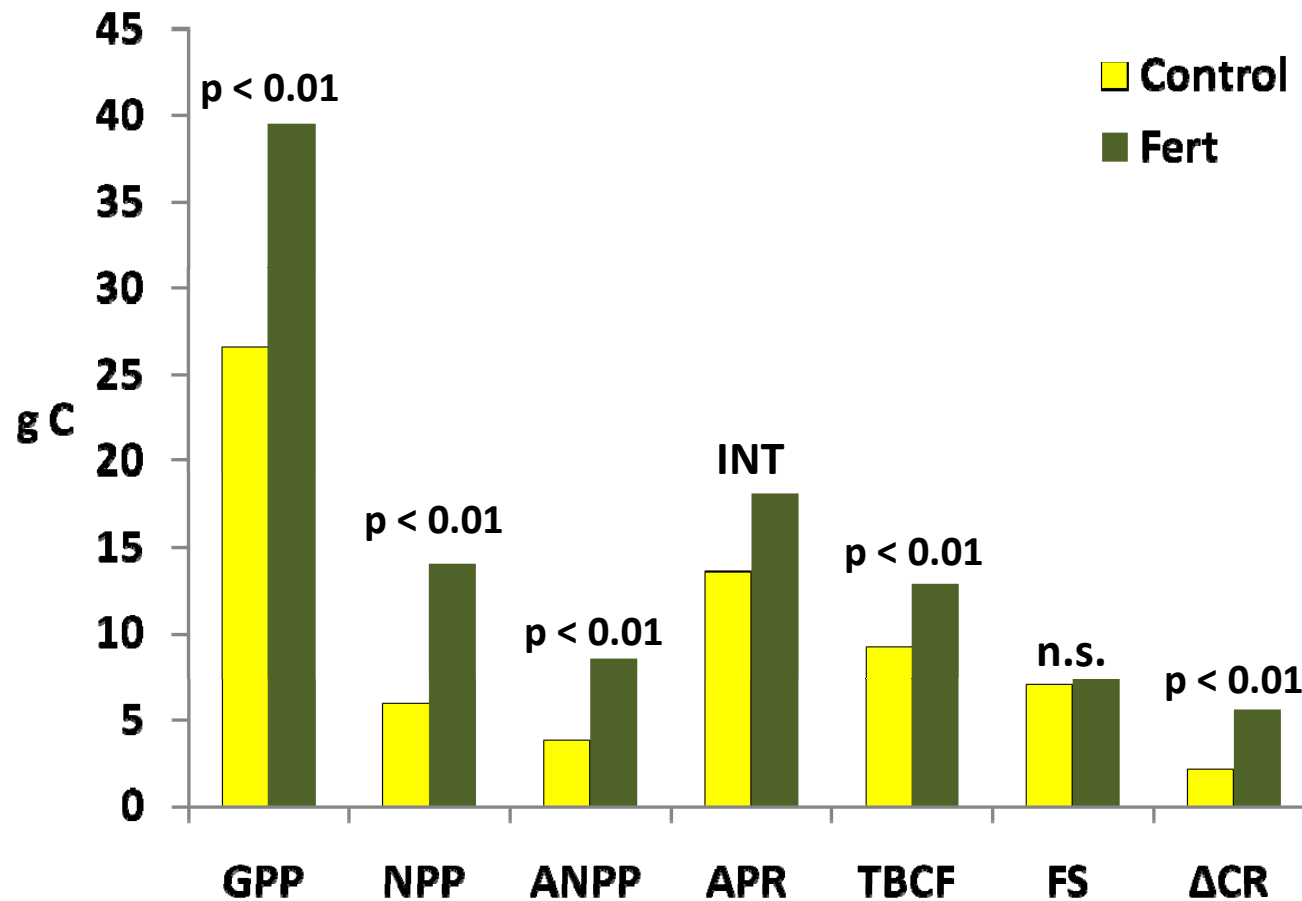
Other Method Details

- All values integrated over 121 days
- Q_{10} 2.0 for respiration rates (Ryan et al. 1991)
- All data treatment-combo specific
- Harvest vs. other tree measurements

Growth Is Similar

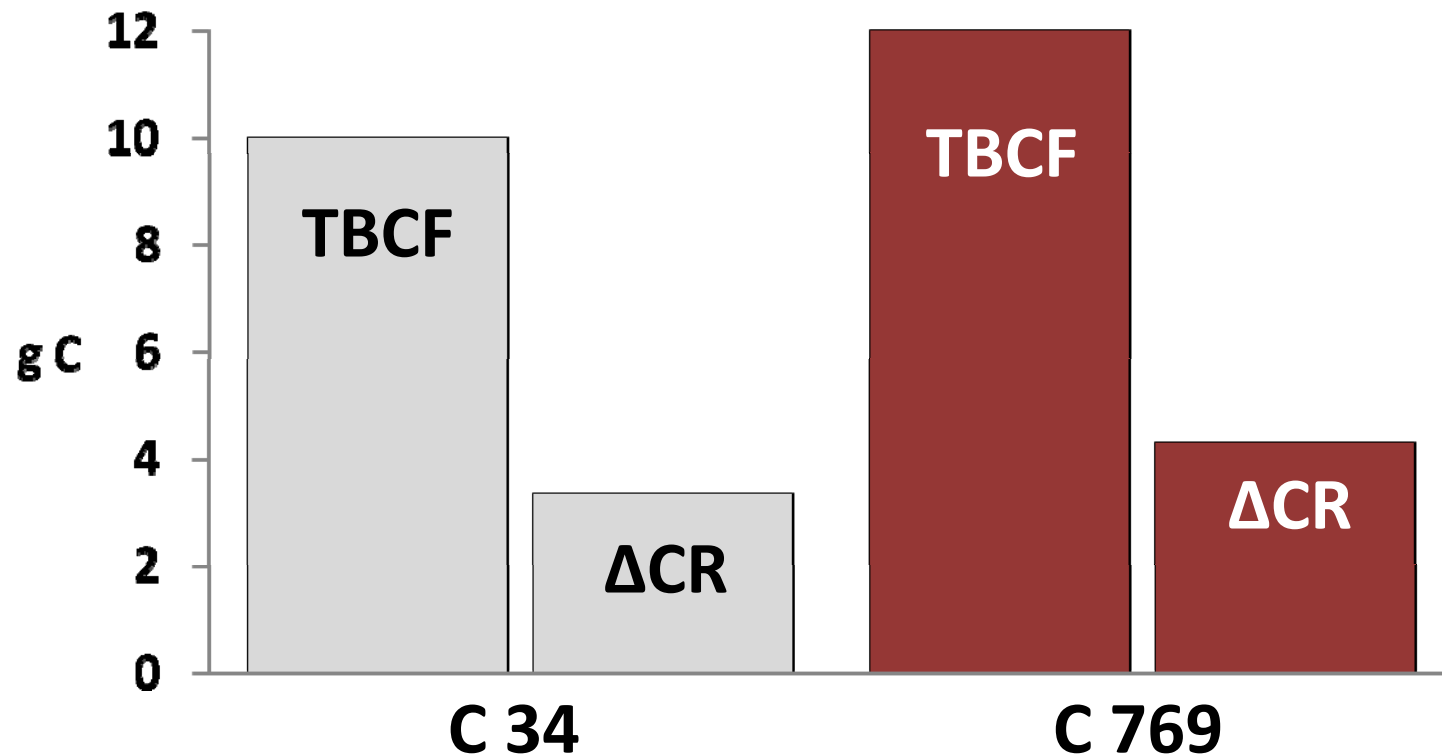


Fertilizer Effect on C Allocation

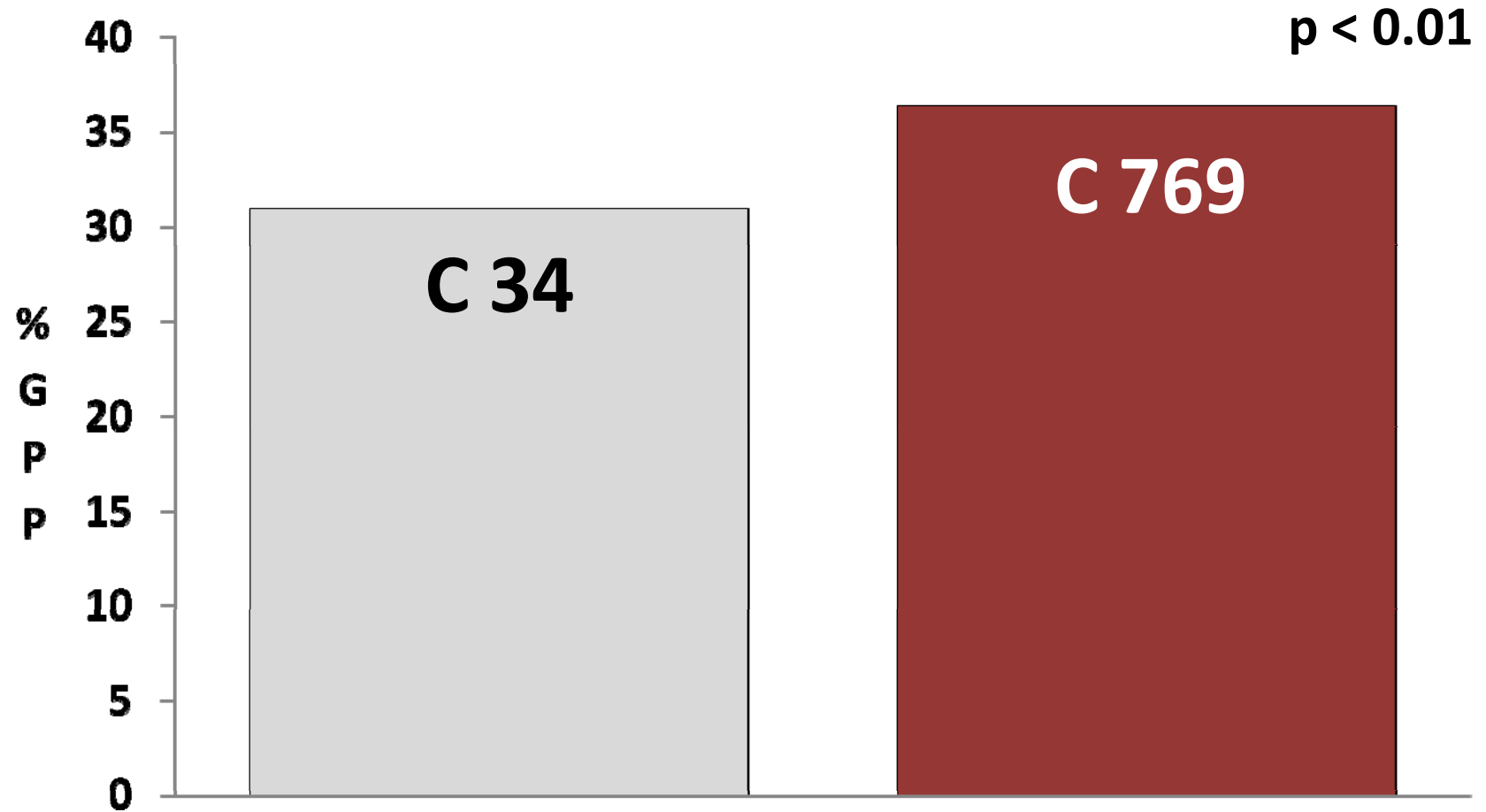


Belowground Allocation Clonal Effect

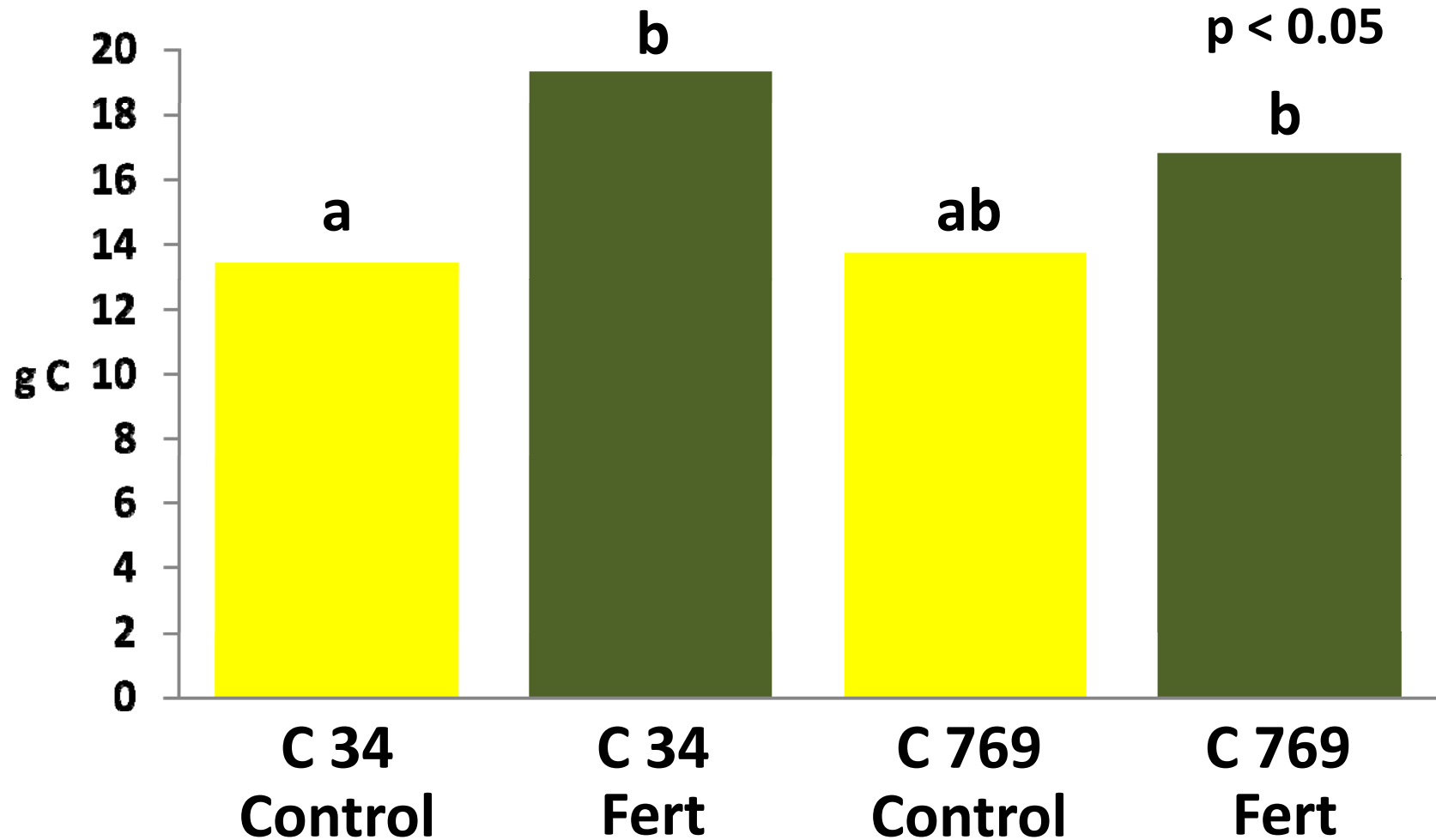
$p < 0.01$



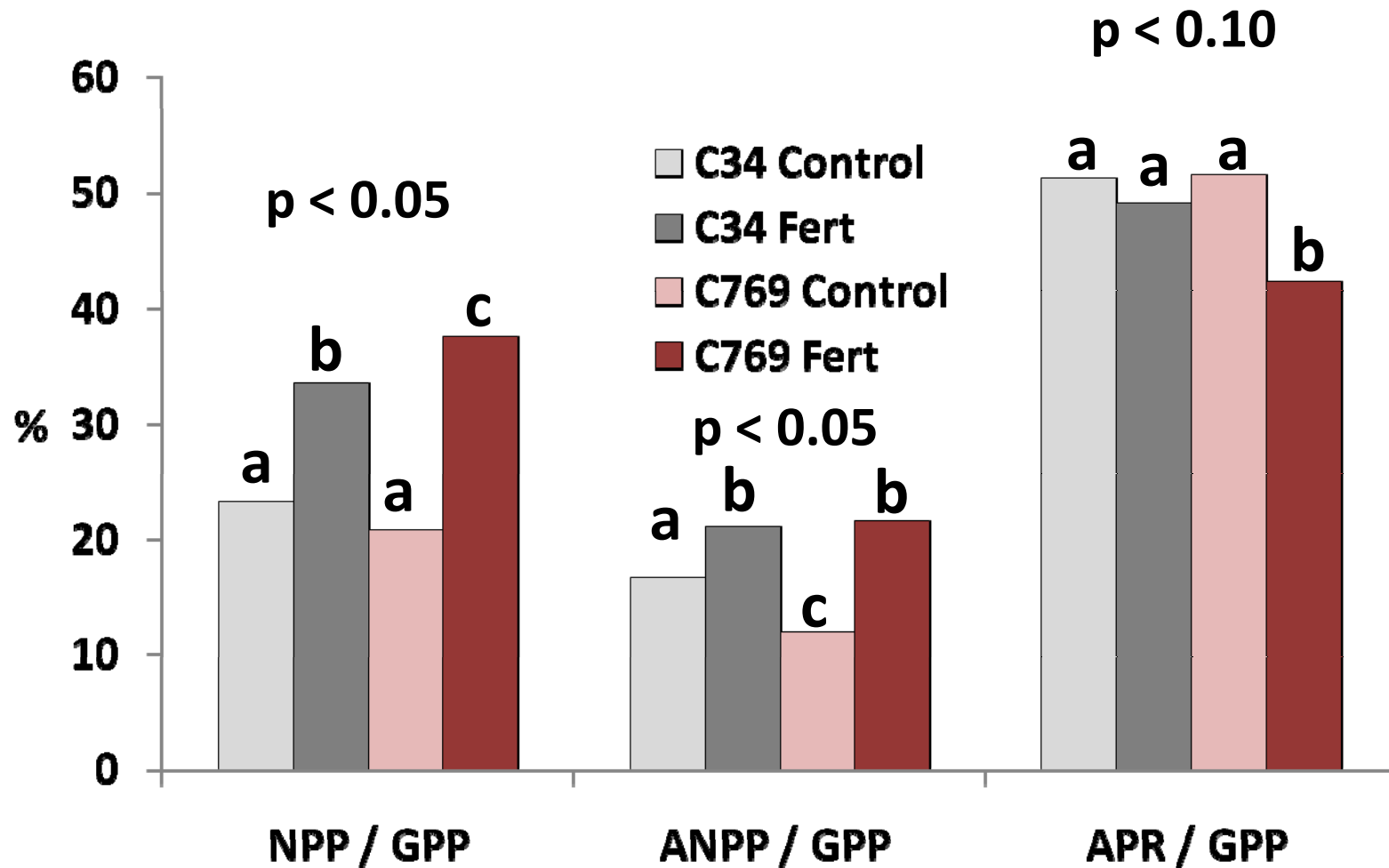
Total Belowground C Flux



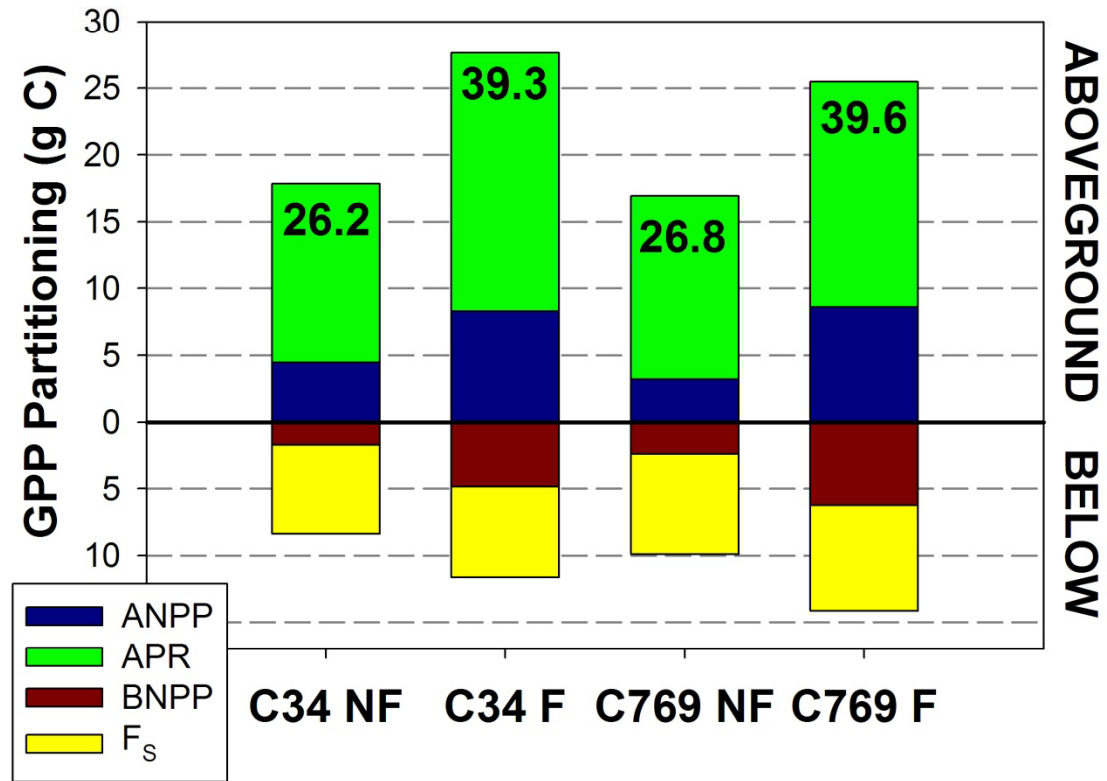
Aboveground Respiration Interaction



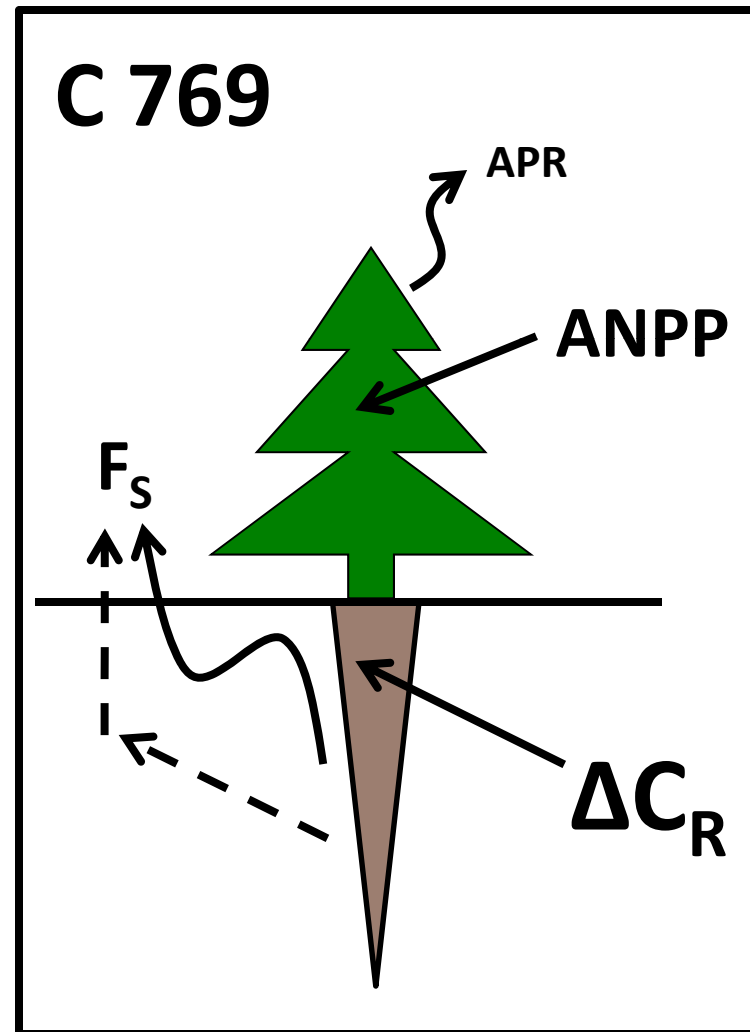
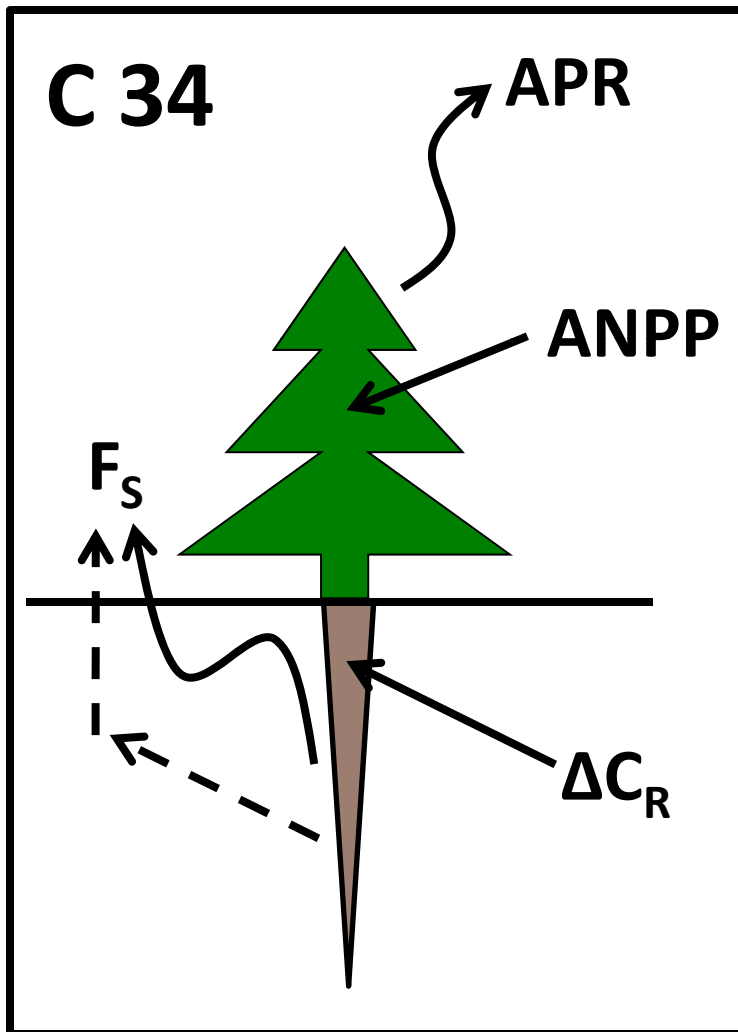
Clone x Fert Allocation Interactions



Whole Carbon Budget

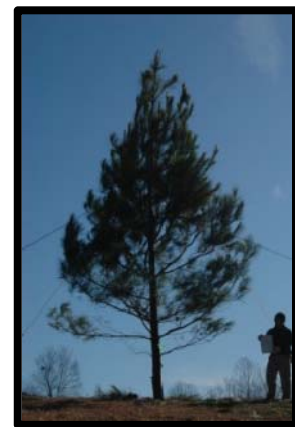


Differences in Clonal Allocation



Conclusions and Implications

- So how do clones respond to fertilizer?
 - Photosynthesis..... Some clones (King et al. 2008)
 - Biomass partitioning..... (Stovall et al. 2011)
 - Respiratory C fluxes..... This greenhouse study
- Can't generalize across clones
- Can we find ideotypes?



Questions?

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