Effects of Phosphorus on Morphology of Hydroponically Grown *Scaevola aemula* R. Br. 'Whirlwind Blue'

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Introduction

Scaevola aemula:

- Purple, white flowers
- Hanging baskets
- Native Australian plant
  - *Low Phosphorus Soils*

Introduction

- Australian native plants sensitive to phosphorus:
  - *Banksia ericifolia*
    - Parks et al., 2000
  - *Hakea prostrata*
    - Shane et al., 2004
    - Shane and Lambers, 2004
- Growers report poor growth when *Scaevola* grown with fertilizers containing 1 N: 1 P_2O_5

Introduction

- Zhang et al., 2004:
  - *Scaevola* ‘New Wonder’ grown in hanging baskets
  - Phosphorus ($mg \cdot L^{-1}$):
    - 0
    - 14.5
    - 29
    - 43.5
    - 58
    - 72.5
    - 87

Introduction

- Zhang et al., 2004:
  - Phosphorus reduced:
    - Stem length and number
    - Leaf area
    - Flower number
  - Phosphorus and medium pH negatively correlated
  - Poor growth could be due to high P or low pH

Objective

Determine how *Scaevola* morphology is impacted by phosphorus concentration under controlled pH

Materials and Methods

- Commercially grown rooted cuttings
- Substrate gently removed
- Cuttings transplanted:
  - Plastic containers
  - Covered in aluminum foil
  - Elevated in holes in lids using polyester batting
  - Oxygen provided using aquarium pumps

Materials and Methods

- Modified Hoagland Solution:
  - $NH_4H_2PO_4$
  - Phosphorus concentrations ($mg \cdot L^{-1}$ P):
    - 0
    - 20
    - 40
    - 60
    - 80
  - NH_4Cl
  - pH measured twice and adjusted weekly (5.5-6.5)
  - Solutions replenished every other week

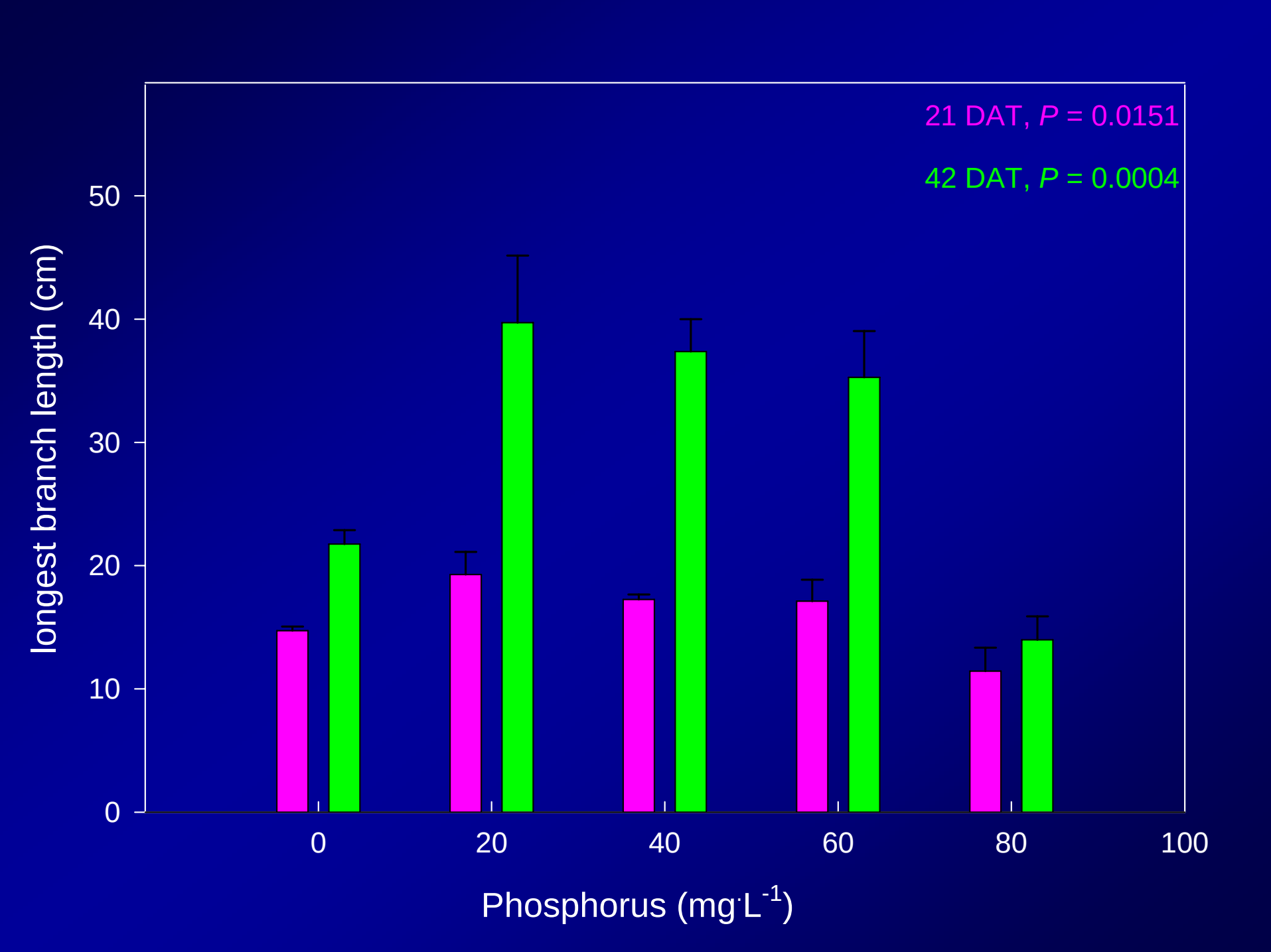
Data Collected

- 21 and 42 Days After Transplant (DAT):
  - Longest stem and root length
  - Leaf area
- 42 DAT:
  - Number of flowering branches
  - Total flower number
  - Foliar nutrient concentrations

Experimental Design

- Randomized Block Design
- 3 Blocks
- 8 sub-samples (plants)
- General Linear Models
- Statistical Analysis Systems (Cary, N.C.)

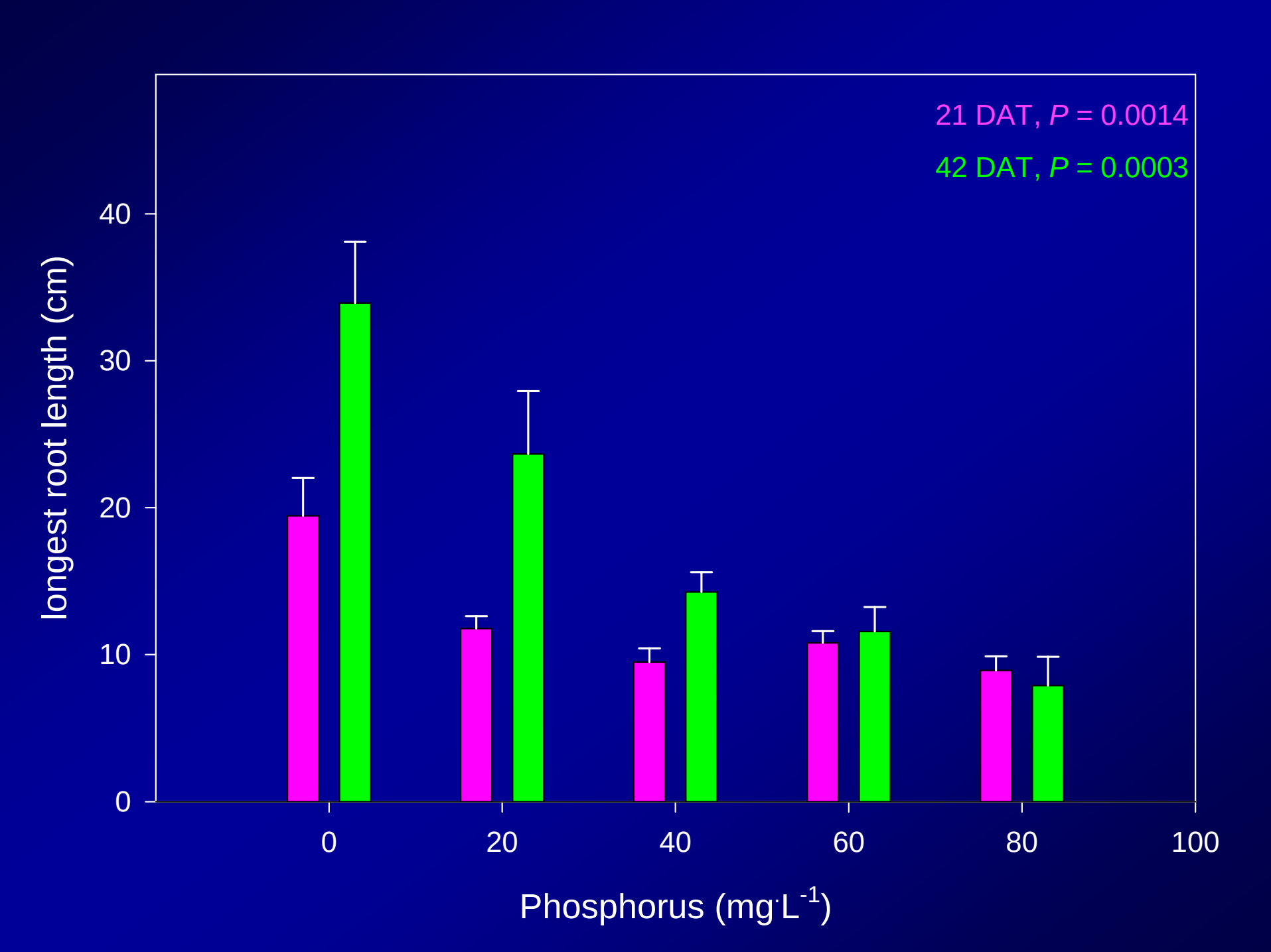
Results

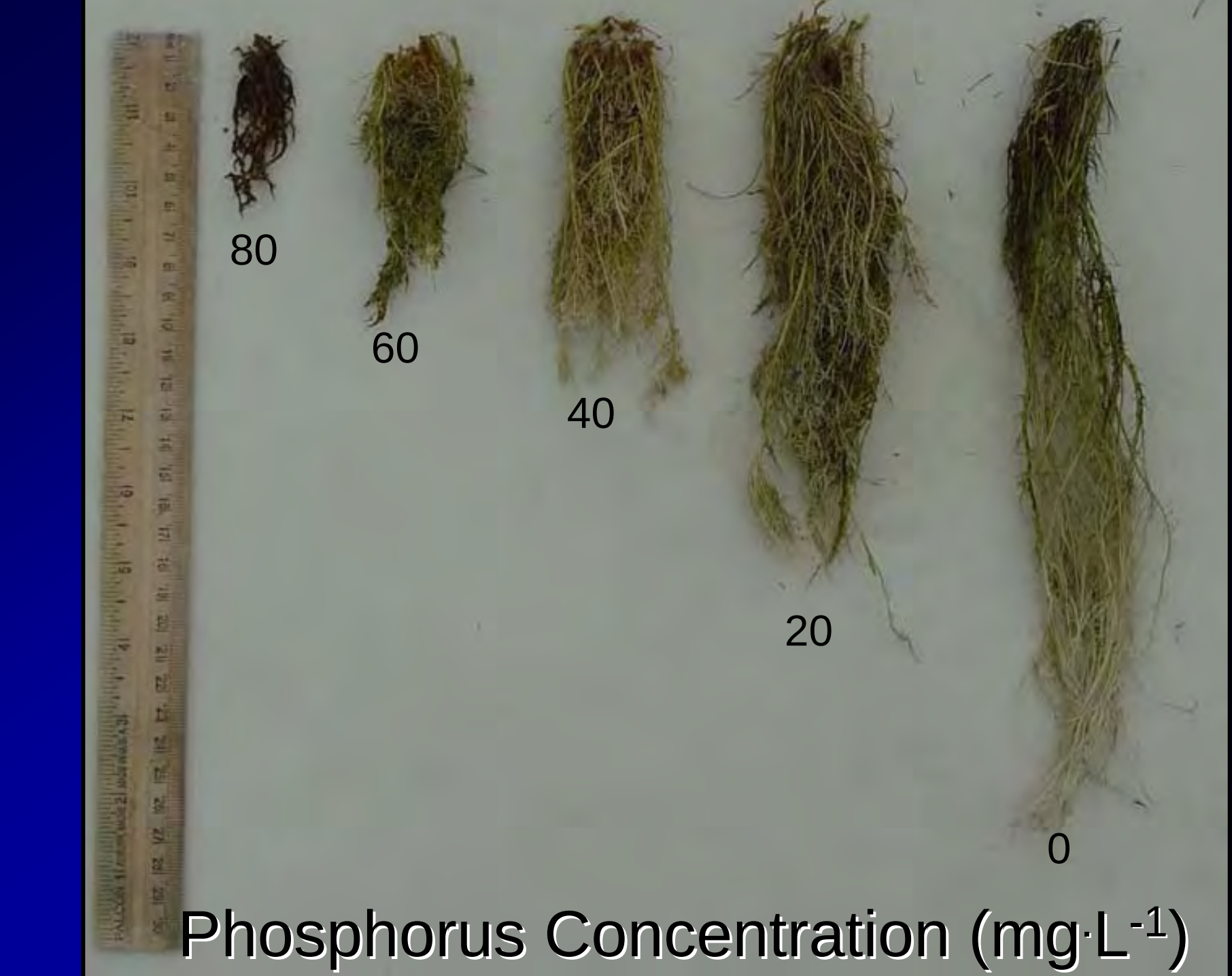

21 DAT, P = 0.0151
42 DAT, P = 0.0004
longest branch length (cm)
0
10
20
30
40
50
0
20
40
60
80
100
Phosphorus (mg·L-1)

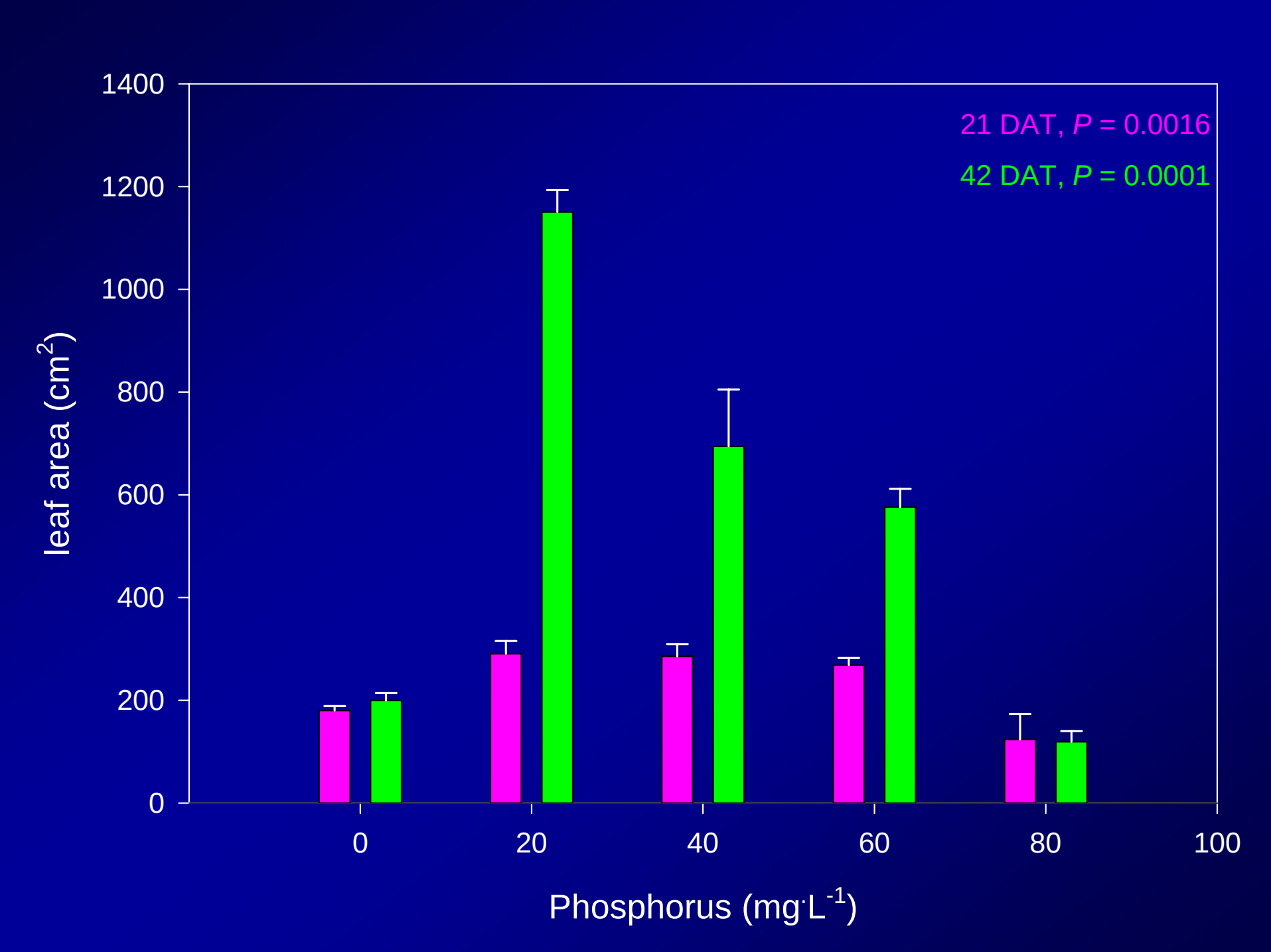
Phosphorus Concentration ($mg \cdot L^{-1}$)

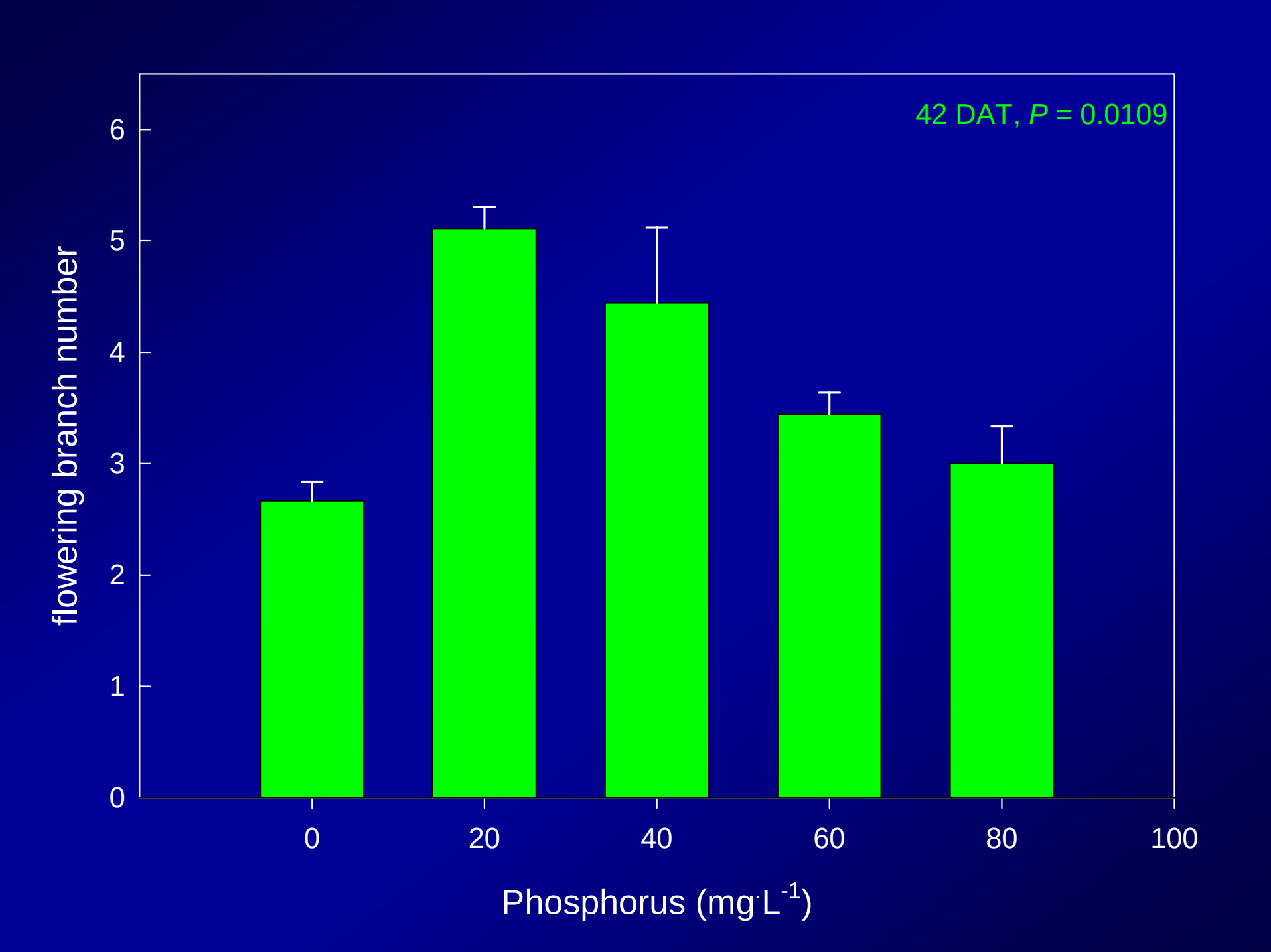
42 DAT

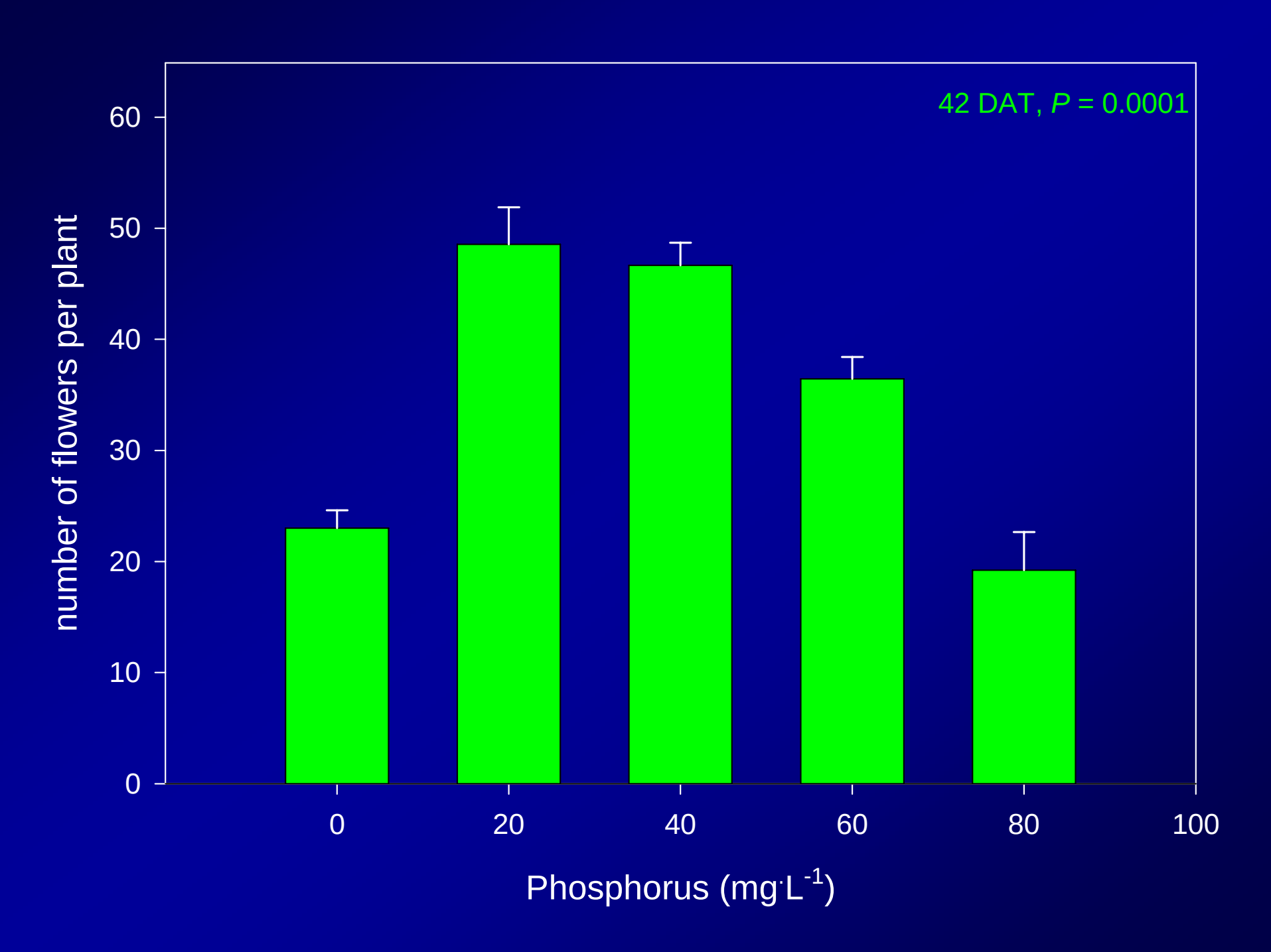
80 mg·L^{-1} Phosphorus


21 DAT, P = 0.0014
42 DAT, P = 0.0003
longest root length (cm)
0
10
20
30
40
0
20
40
60
80
100
Phosphorus (mg·L-1)


80
60
40
20
0
Phosphorus Concentration (mg·L-1)


21 DAT, P = 0.0016
42 DAT, P = 0.0001
leaf area (cm2)
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
Phosphorus (mg·L-1)


42 DAT, P = 0.0109
flowering branch number
0
1
2
3
4
5
6
0
20
40
60
80
100
Phosphorus (mg·L-1)


42 DAT, P = 0.0001
number of flowers per plant
0
10
20
30
40
50
60
0
20
40
60
80
100
Phosphorus (mg·L-1)

Foliar [Macronutrient] (42 DAT)

Applied P	% N	% P	% K	% Mg	% Ca
0	2.5 c	0.04 d	6.1 a	0.39 b	1.6 c
20	5.0 a	1.1 c	6.3 a	0.58 a	2.2 a
40	4.4 a	1.6 ab	6.1 a	0.51 a	1.9 b
60	4.3 a	2.0 a	6.1 a	0.51 a	1.9 b
80	3.5 b	1.5 bc	4.1 b	0.54 a	1.9 b
P	0.0003	0.0001	0.0019	0.0030	0.0007

Conclusions

- 0.2-0.5% Foliar P sufficient
  - Mills and Jones, 1996
- >1% P may result in foliar toxicity
  - Marschner, 1995
- Phosphorus toxicity:
  - Reduction of shoot growth
  - Foliar necrosis and chlorosis

Conclusions

- High P:
  - Reduced shoot length and leaf area
  - Reduced flower development
- > 20 $mg \cdot L^{-1}$ P resulted in higher than recommended foliar P concentrations
- 80 $mg \cdot L^{-1}$ P severely reduced shoot and root growth and caused foliar chlorosis

Thank you!

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