FACULTAD DE AGRONOMÍA
E INGENIERÍA FORESTAL
PONTIFICIA UNIVERSIDAD
CATÓLICA DE CHILE

IUFRO

NUTRIENT DYNAMICS OF PLANTED FORESTS CONFERENCE

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Understanding Roots Response to Fertilizer Location in a Chilean Mediterranean Tree Resistant to Summer Drought

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27th November 2012

MEDITERRANEAN REGION - CHILE

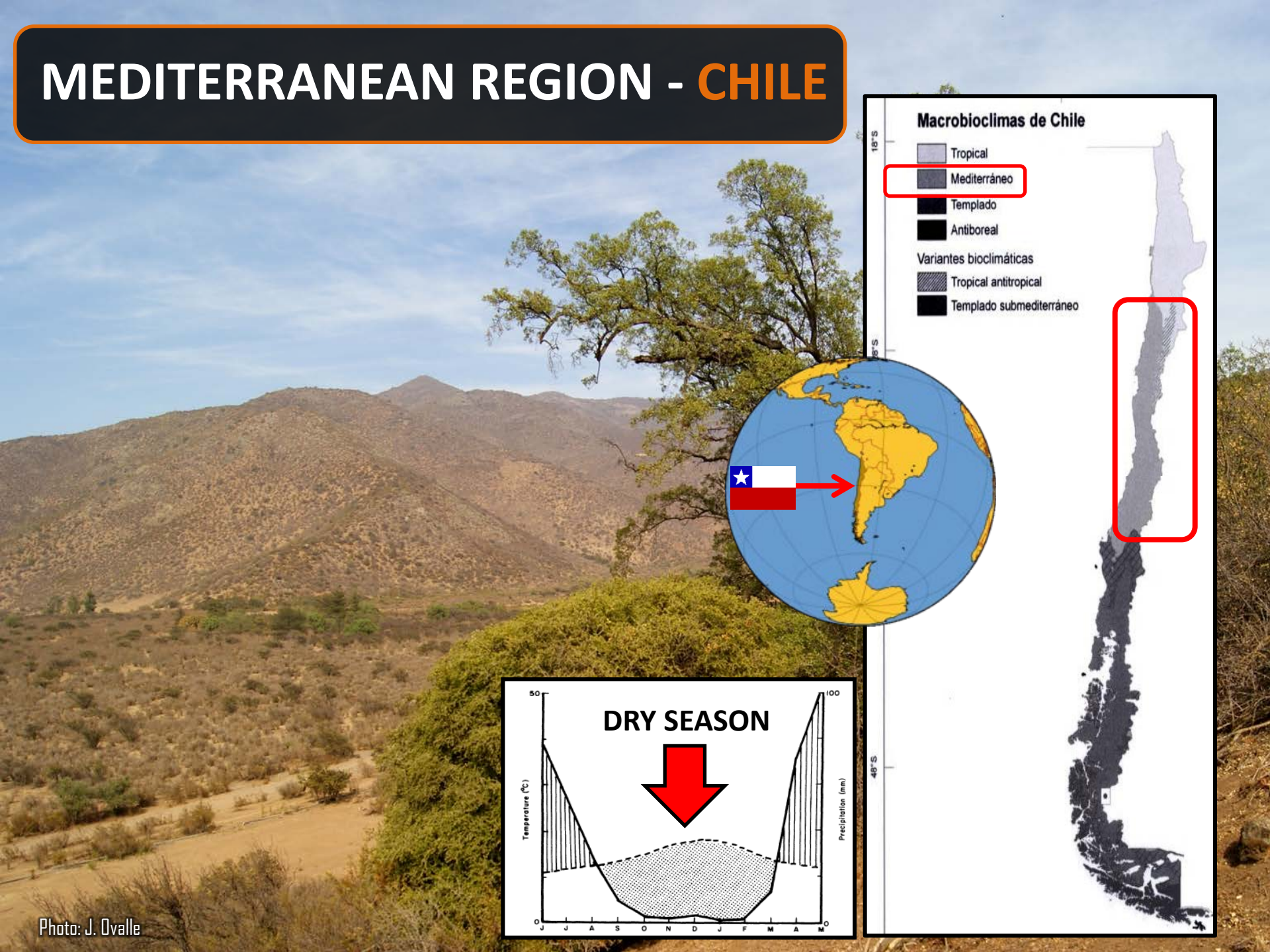
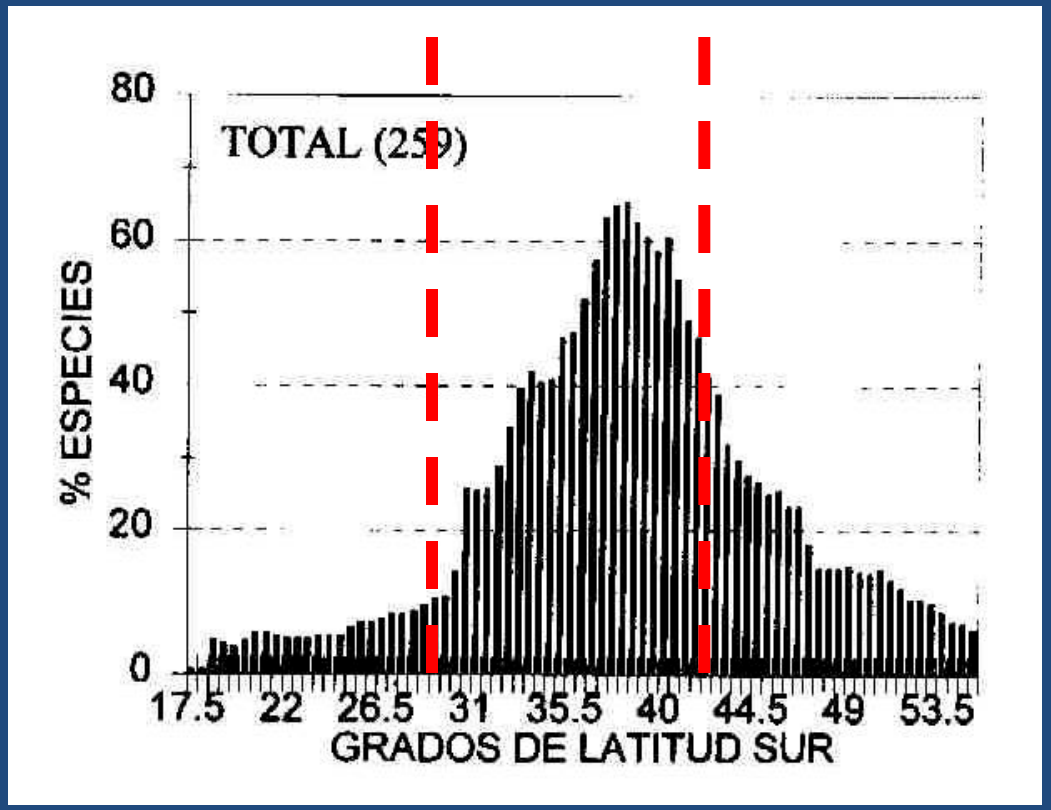


Photo: J. Ovalle

MEDITERRANEAN ECOSYSTEM – CHILE

High biodiversity + High endemism + High anthropic impact

Myers *et al.,* 2000. Nature 403



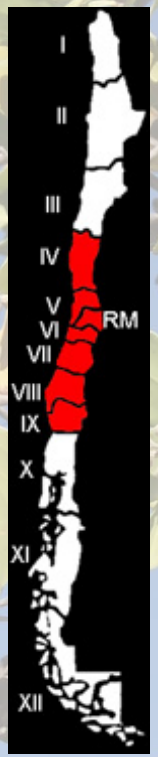
Villagrán e Hinojosa, 1997

STUDY SPECIES

***Quillaja saponaria* (Mol.)**

QUILLAY

- **Family: Quillajaceae**
- **Endemic, evergreen**



- From IV to IX Region.
- Degraded and dry soils.
- Present in late successional stages.
- Shadow intolerant.

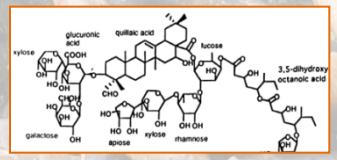
Photo: J. Ovalle

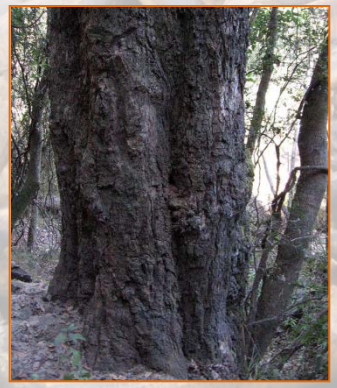
High economic interest by Quillay tree bark due the wide range of industrial applications.

OVEREXPLOITATION OF BARK

Saponins properties:

- Foaming
- Adjuvant in vaccines
- Food emulsifiers
- Medicinal
- Cosmetic moisturizing
- Photography

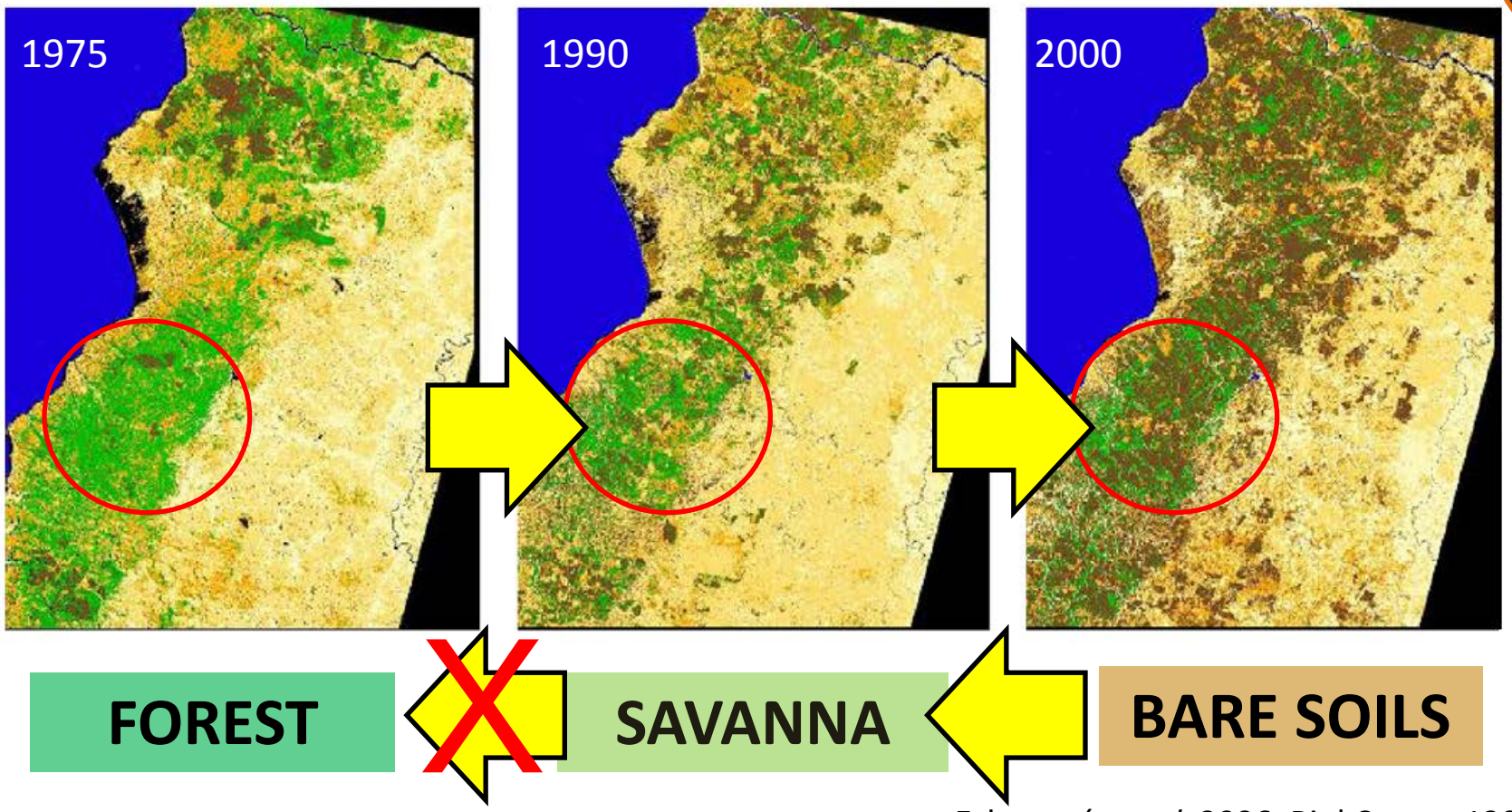




San Martín, 1999. Econ Botany 53(3)

Photo: J. Ovalle

LOSS AND DEGRADATION OF NATIVE FOREST



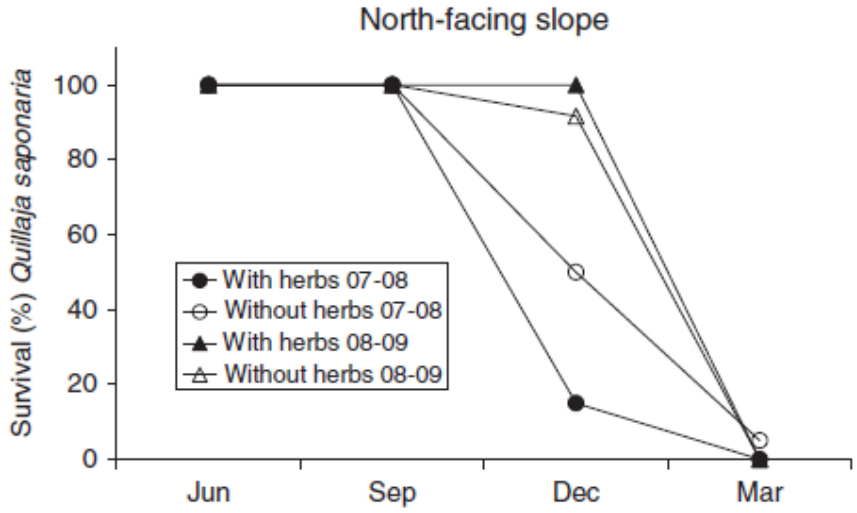
Echeverría *et al*, 2006. Biol Conser 130

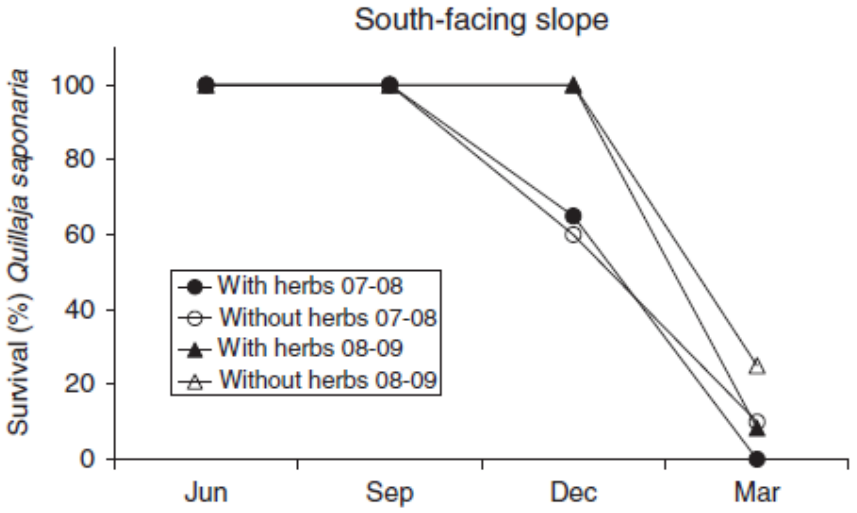
- **67 % reduction of Maule Coast forest.**
- **Loss annual rate = 4,5 %**
- **Low capacity of passive recovery (diverse ecological and climatic factors)**

Reforestation with native species (Sclerophyll forest)

Low survival

Fuentes *et al*, 1984. Oecologia 62(3)
Holmgren *et al*, 2000. Plant Ecol 147
Becerra et al ,2011. J Veg Sci 22





Becerra et al, 2011. J. Vegetation Science 22

NURSERY OF NATIVE SPECIES

- Lack information related to nursery production.

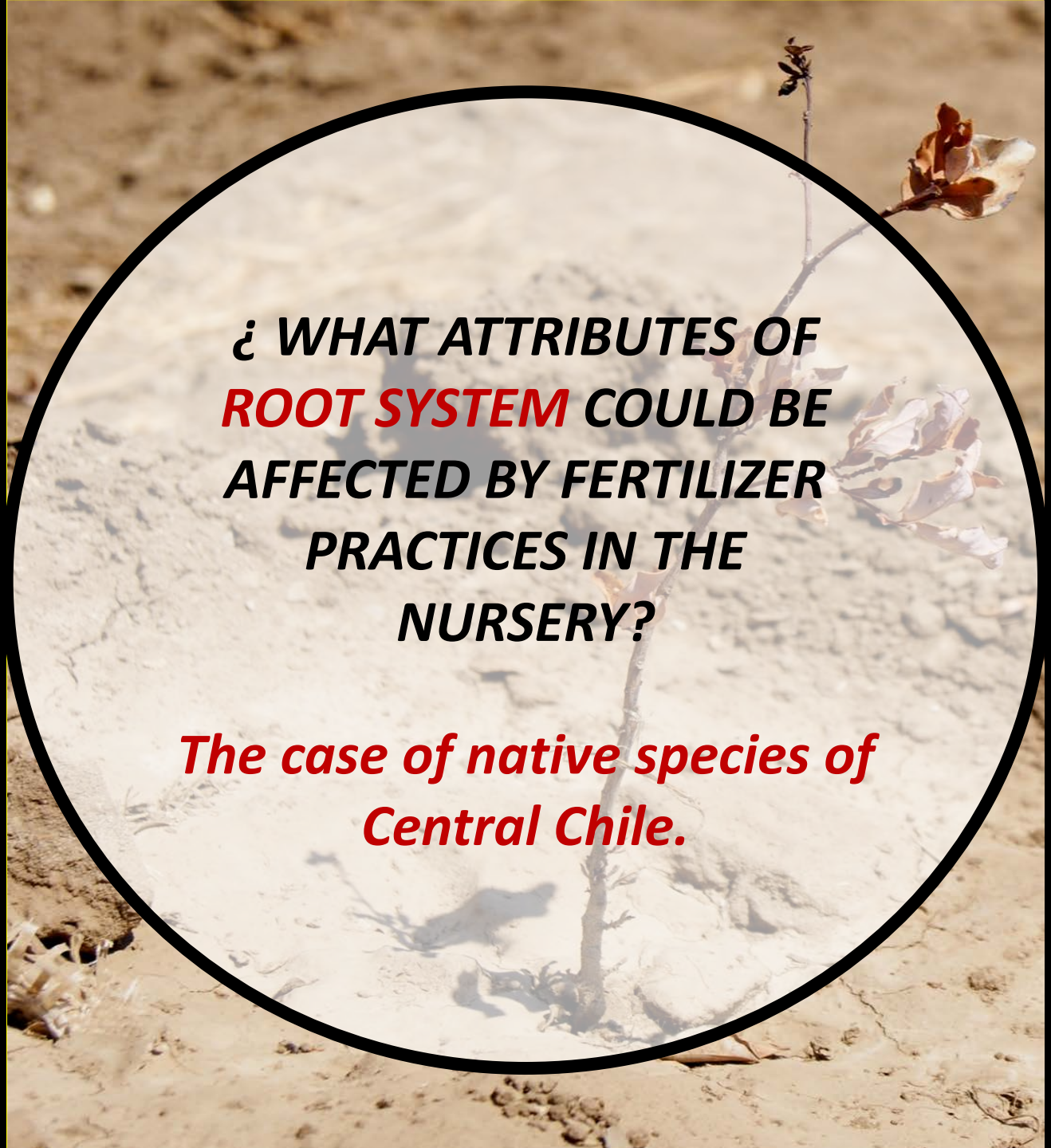
- Nutritional regimens are not related with plant demand.

- Are unknown the potential impacts of fertilization practices in plant quality and its performance post-planting

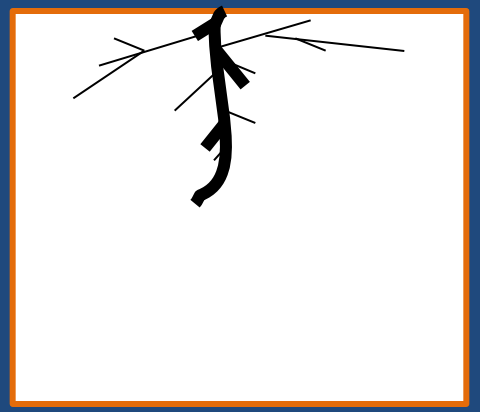
IMPORTANCE OF ROOTS SYSTEM

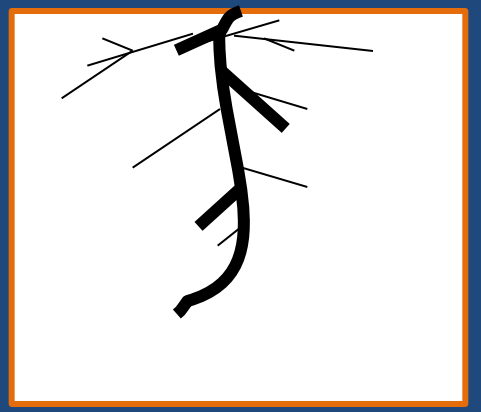
Roots architecture is a key component to seedling success in semiarid conditions.

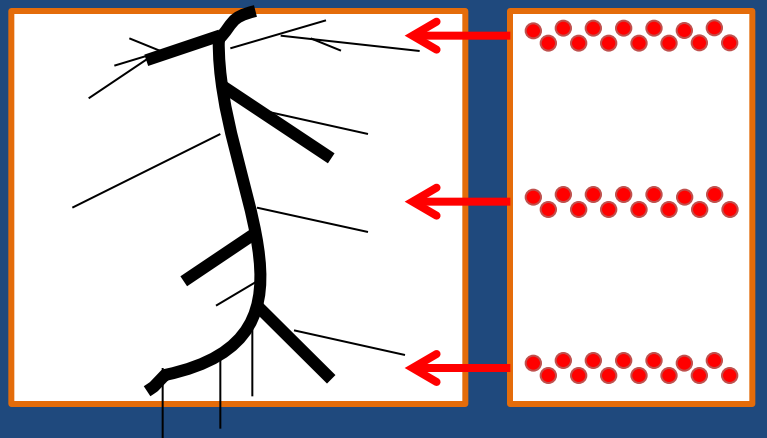
Jacobs et al, 2004. Ann For Sci 61
Grossnickle, 2005. New Forests 30
Villar Salvador et al, 2005. Invest Agrar 14


¿ WHAT ATTRIBUTES OF
ROOT SYSTEM COULD BE
AFFECTED BY FERTILIZER
PRACTICES IN THE
NURSERY?
The case of native species of
Central Chile.
Photo: J. Ovalle

TARGET SPECIES: Different rooting patterns



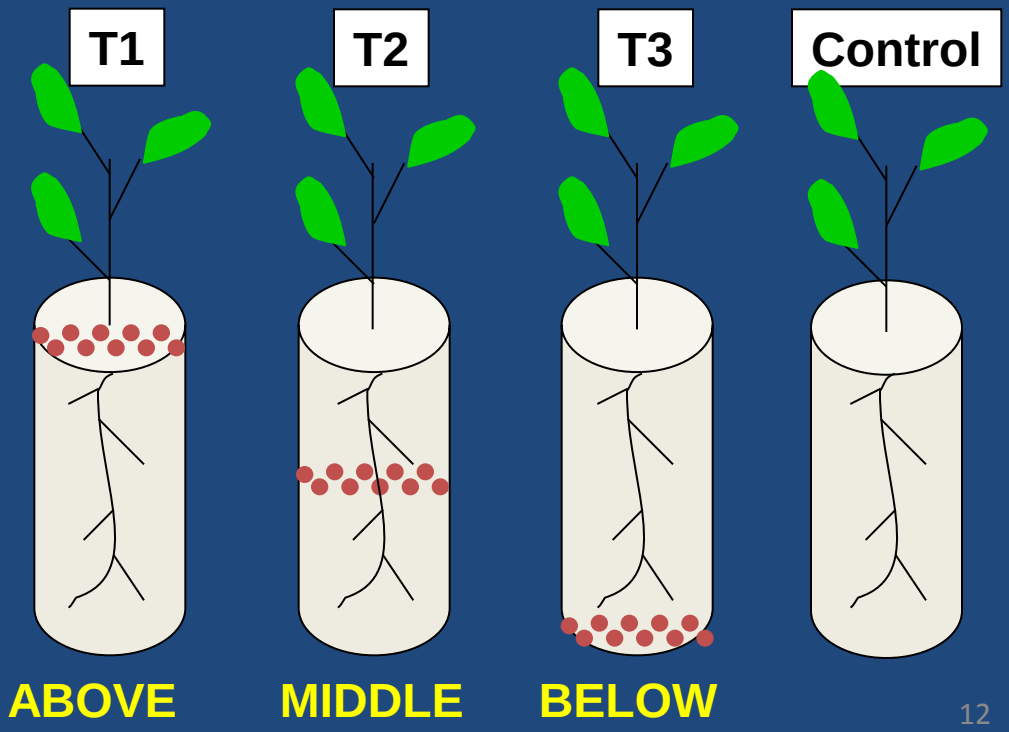




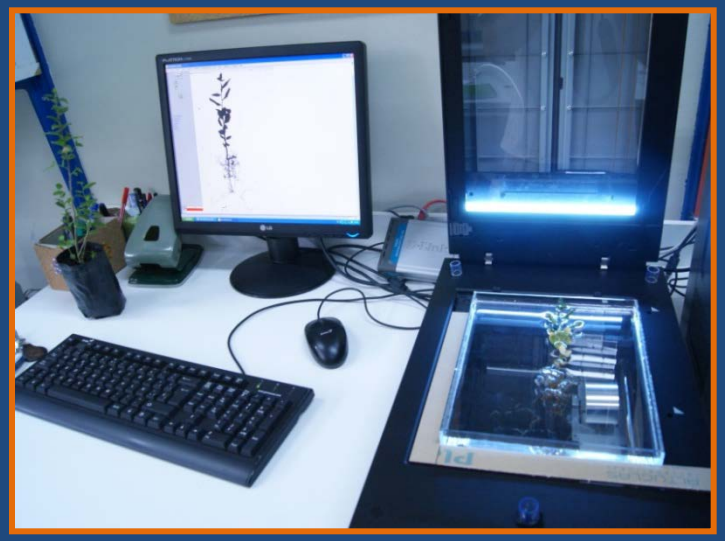
TREATMENTS IN NURSERY

Name	Type of fertilizer	Nutritional composition (%)	Time Release	Rate
Basacote® Plus	Pellets coated with polymers, thermosensitive	08% $N\text{-}NH_4$ 07% $N\text{-}NO_3$ 08% P_2O_5 12% K_2O 02% MgO	12	15,4 g pl^{-1}

- Container volume: 2850 cm^3
- Time production: 8 months
- Site: Greenhouse area in University UC, Santiago



MORPHOLOGICAL VARIABLES



SHOOT:

- Shoot:Root ratio
- Height (cm)
- Collar diameter (mm)
- Nutrient foliar content (%)

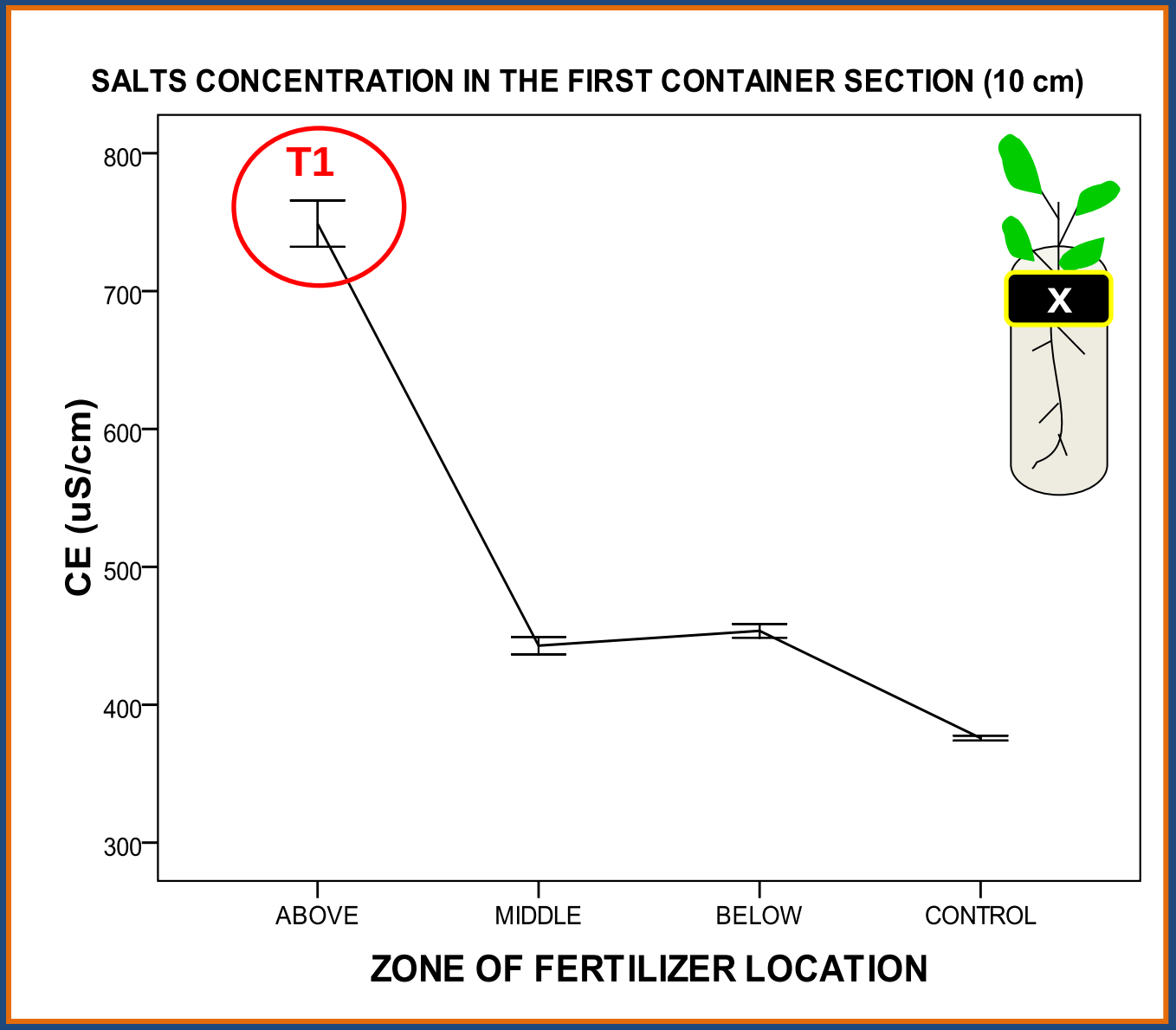
ROOTS:

- Root lenght (cm)
- Average diameter (mm)
- Root volume (cm^3)
- Root density (cm/cm^3 soil)

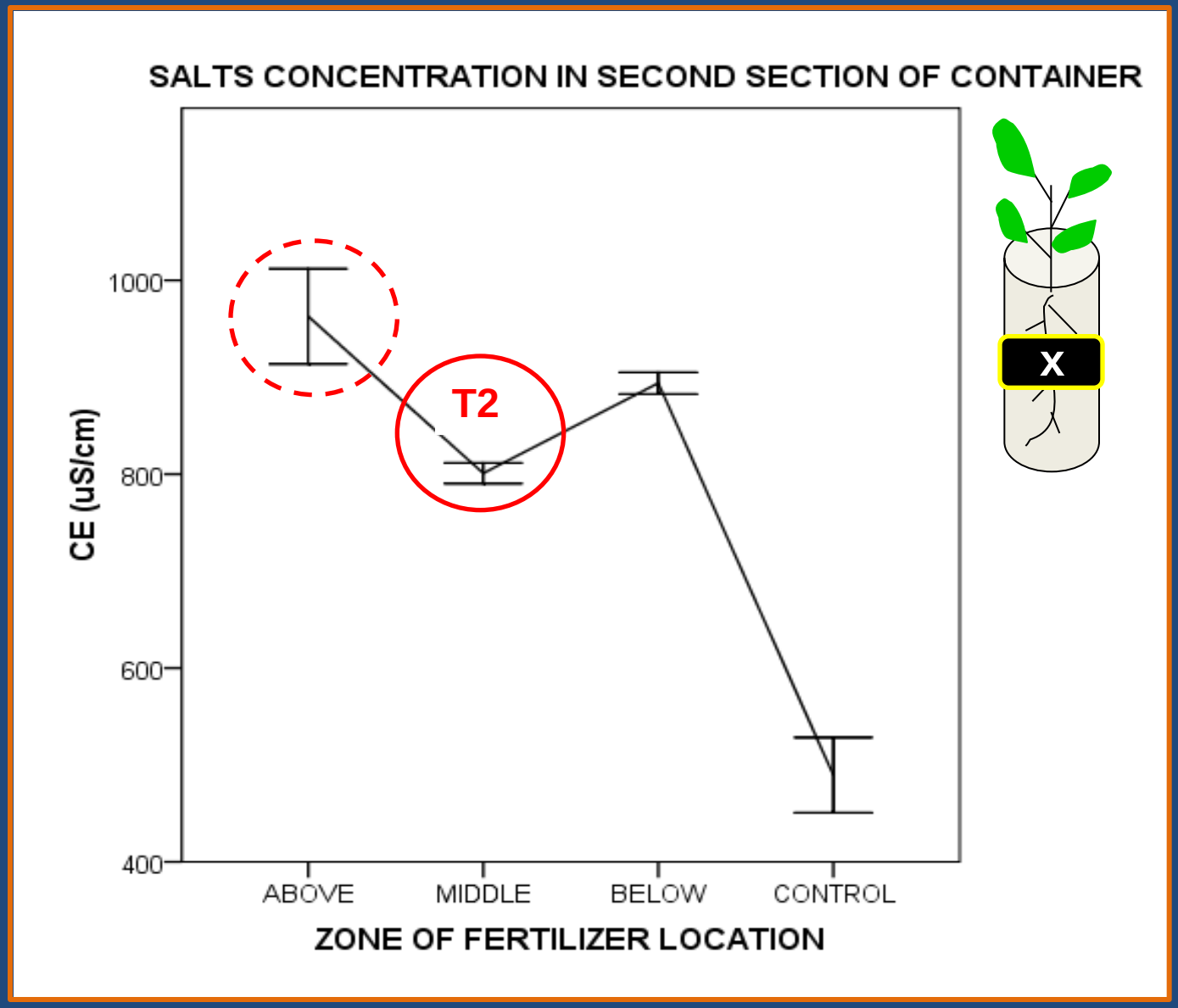
RESULTS

SOIL MEASUREMENTS

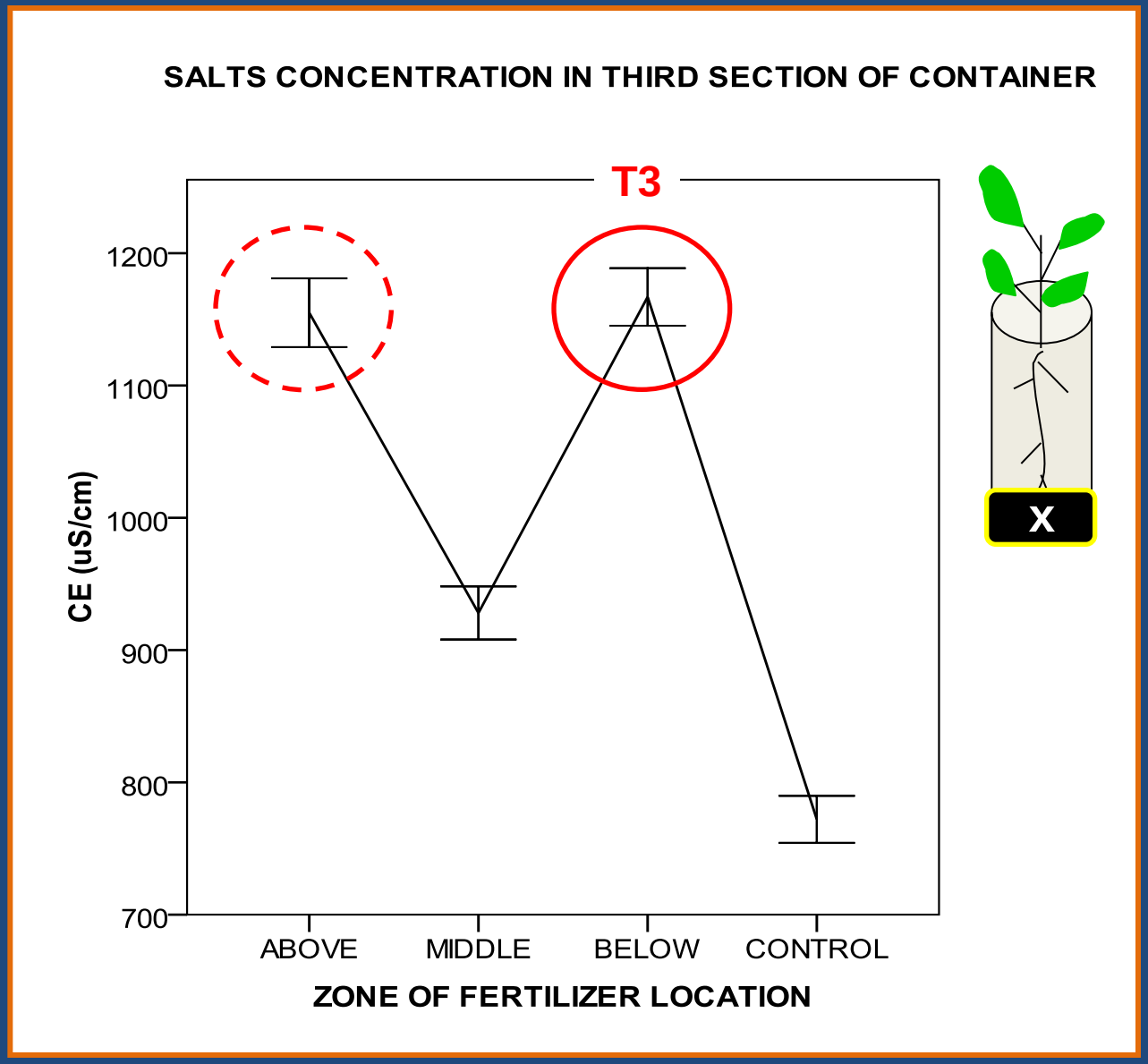
EC in different soil section of container: SECTION 1



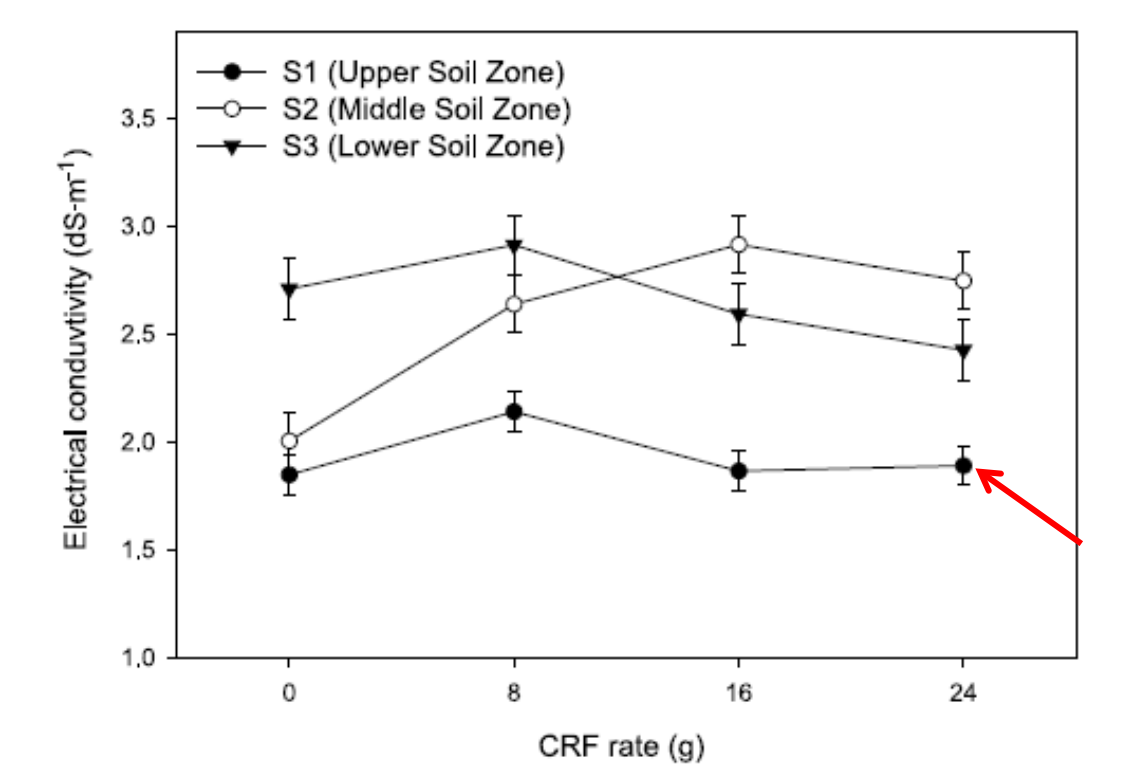
EC in different soil section of container: SECTION 2



EC in different soil section of container: SECTION 3



Evidences of variability of EC in seedlings containerized:



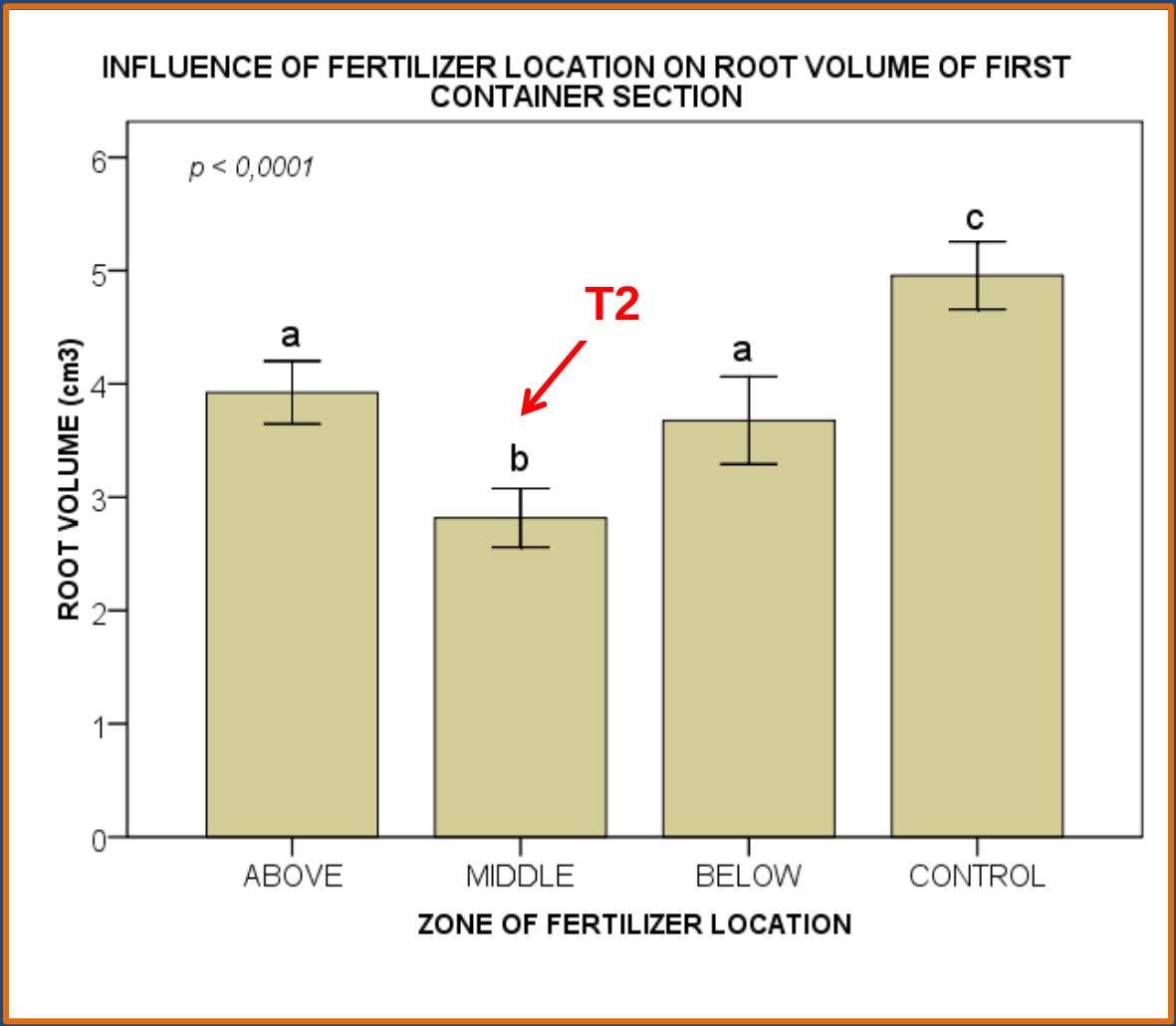
Jacobs et al. 2003. Can J For Res 33

RESULTS

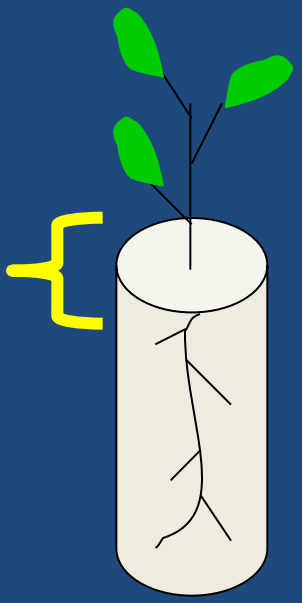
ROOTS MEASUREMENTS

ROOT VOLUME: SECTION 1

T2: Root volume is significantly decreased in the first section, although the fertilizer layer is in the middle zone.

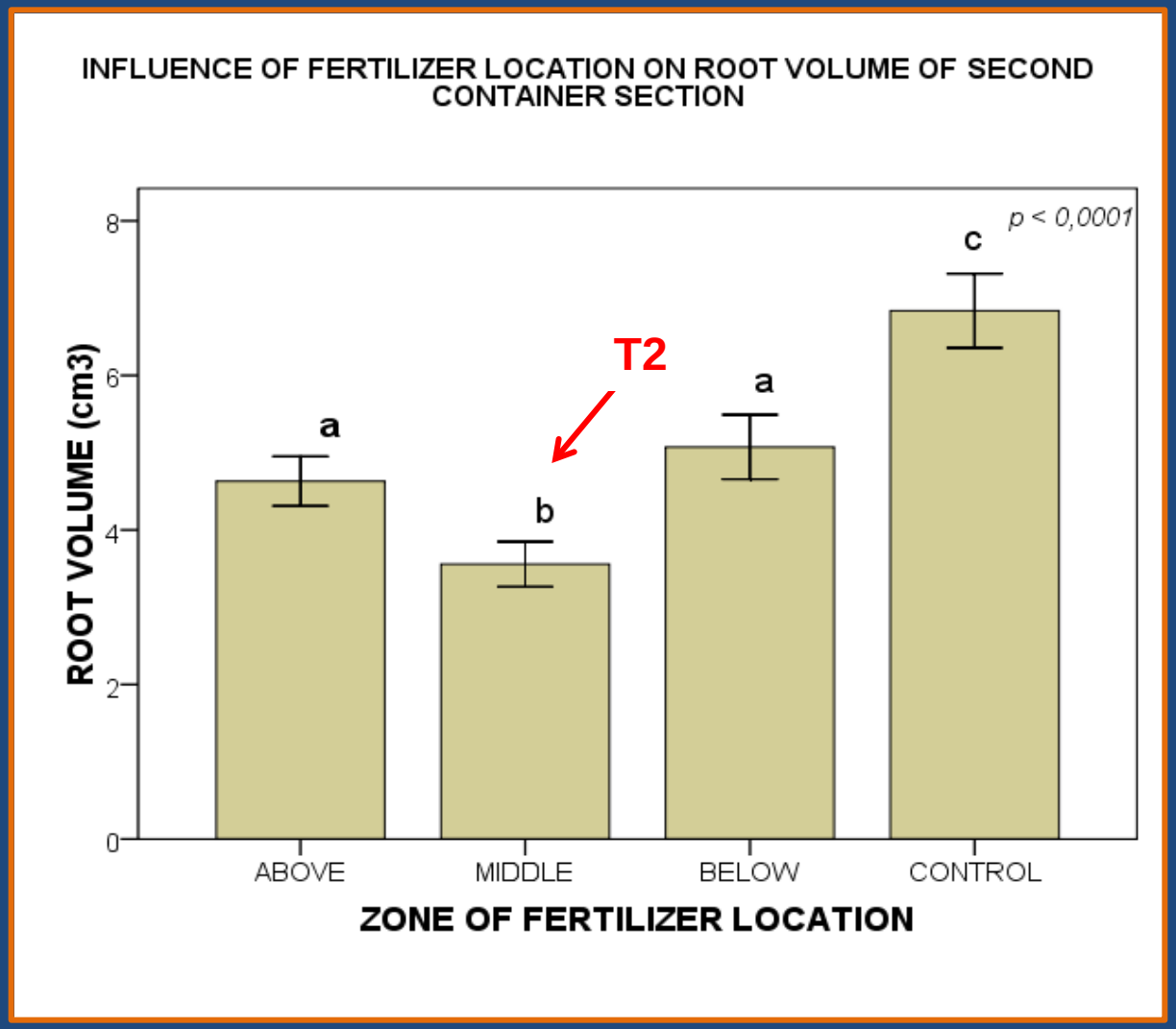


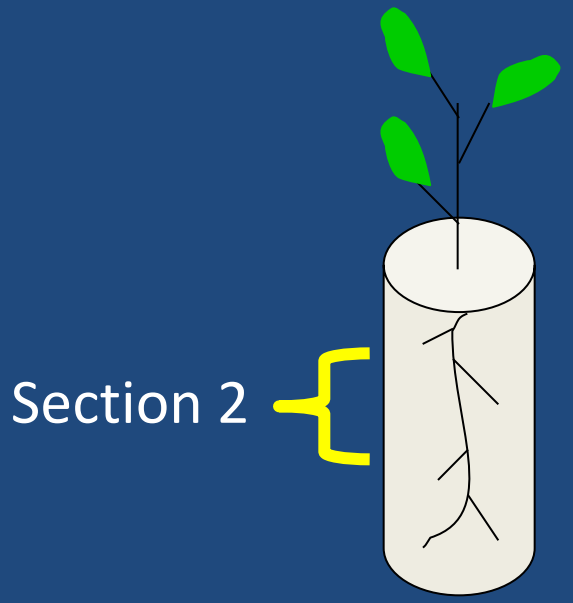
Section 1



ROOT VOLUME: SECTION 2

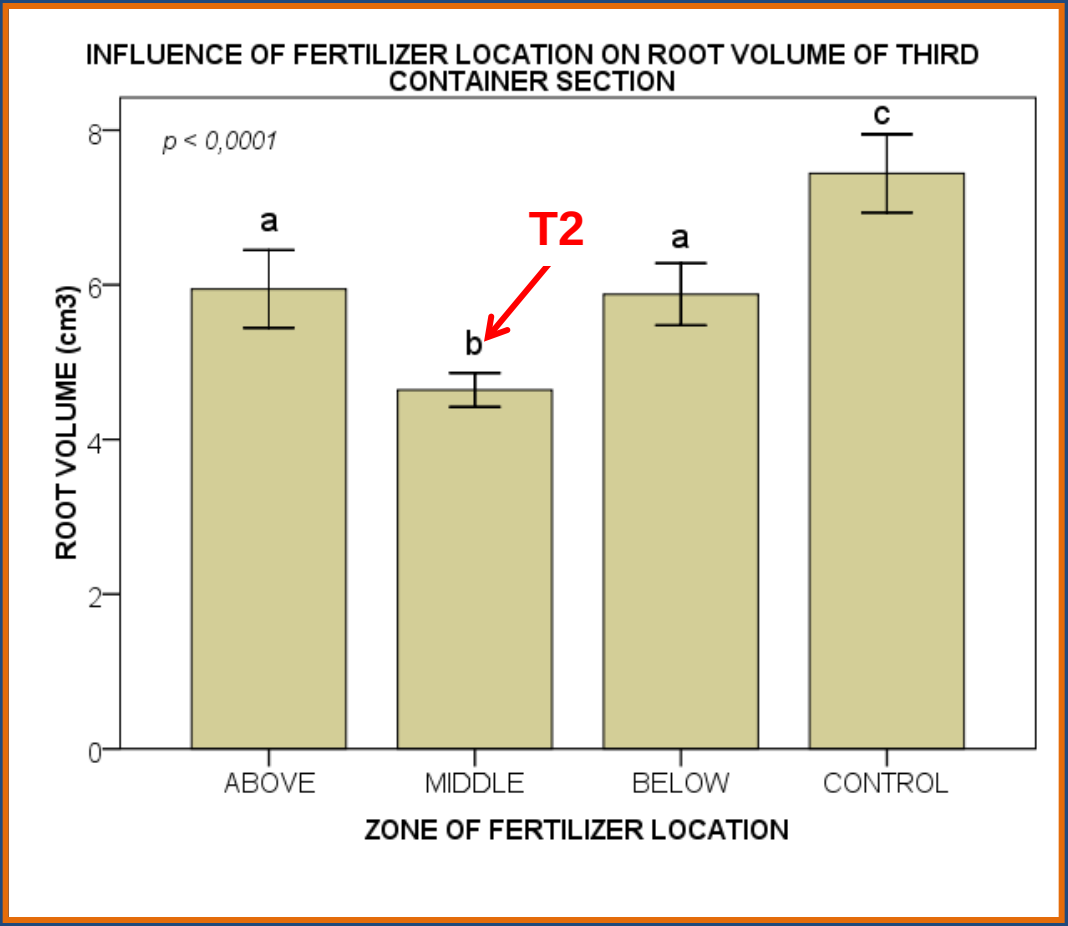
Similar response to before, but now, the fertilizer layer in T2 coincides with the root volume decrease in the second section.

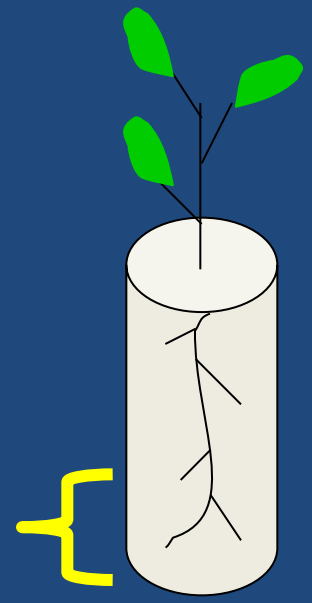




ROOT VOLUME: SECTION 3

The Control showed the greatest volume increase in all sections.

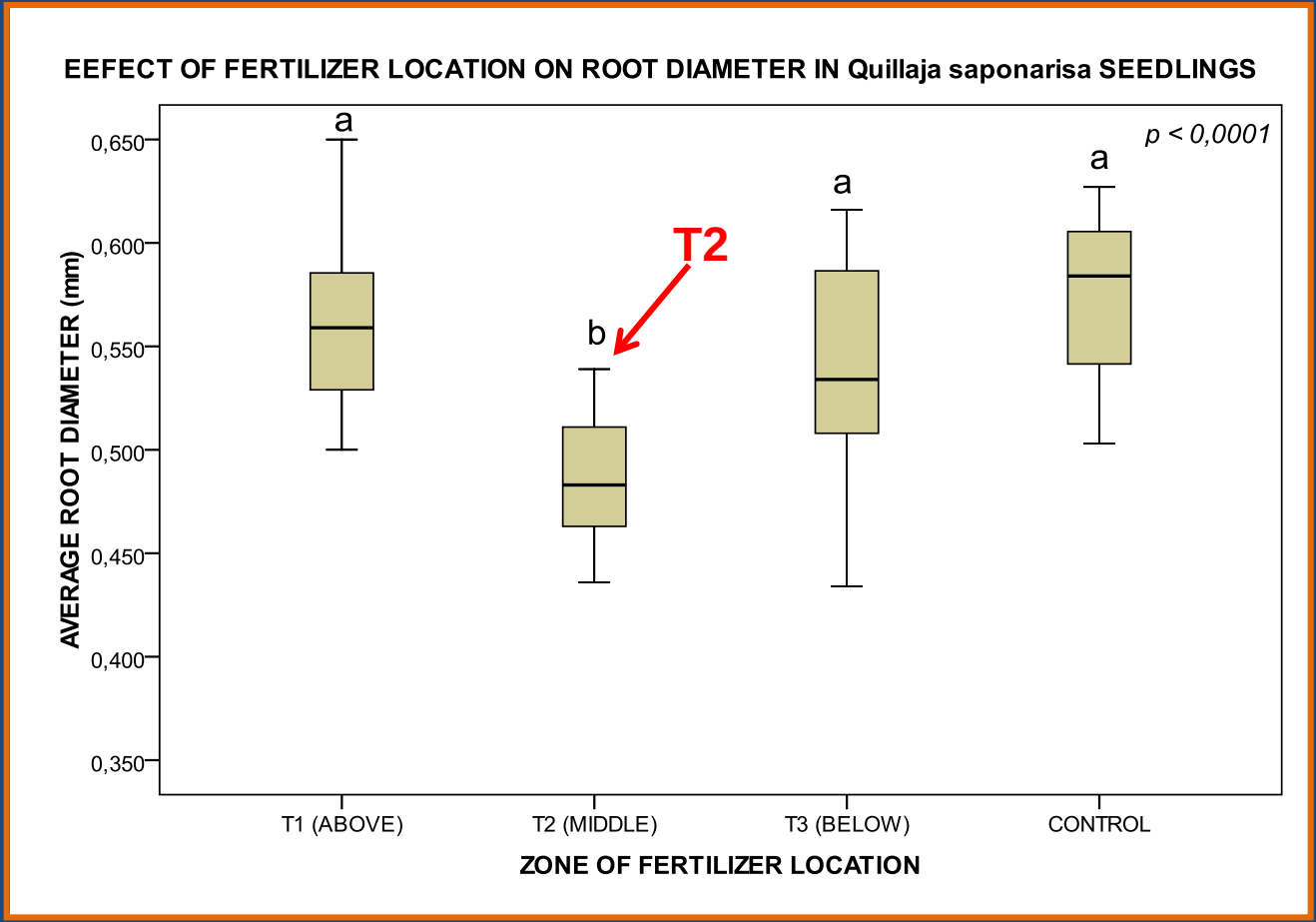




ROOT DIAMETER

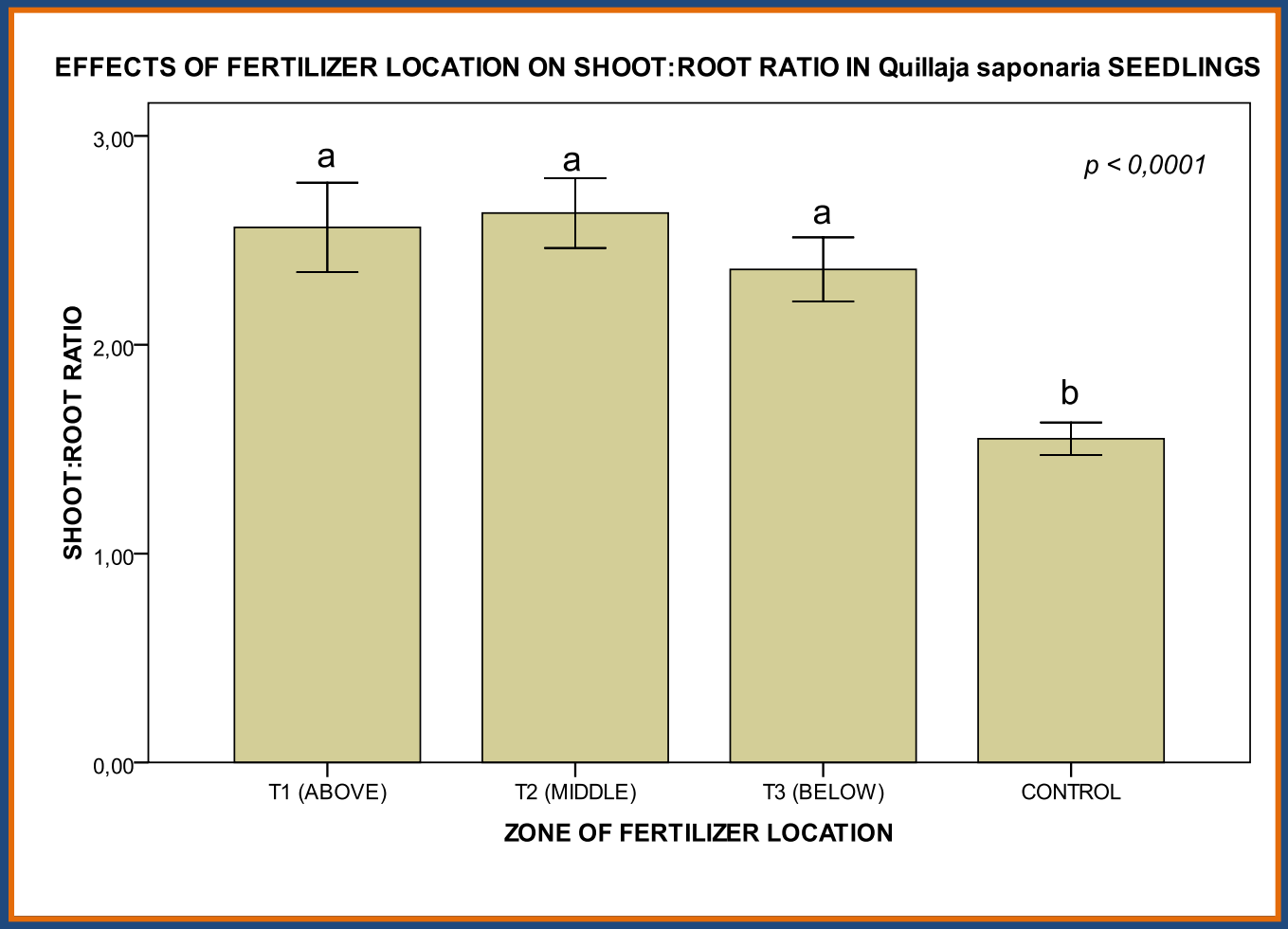
T2: lower average diameter.

Hig EC cause an inhibitory effect in the rizhosphere to root growth.



SHOOT:ROOT RATIO

CONTROL : The lowest shoot:root ratio.



CONCLUSIONS

- Middle zone location **(T2)** of CRF restricts root development (direct contact with high salts concentrations).

- The morphological attributes observed in **CONTROL (T4)** adjust to plants characteristics desired for low water availability conditions (low shoot:root ratio).

- These results suggest the need to consider the root system of native species as a relevant component to whole plant quality, due to evidence of importance of fertilizer application form in the root development of containerized seedlings

FUTURES DIRECTIONS

Fotografía: JF Ovalle

Acknowledgements…

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