

Interaction between farming type, nutrient uptake and plant material in Strawberry tree fruit production and quality



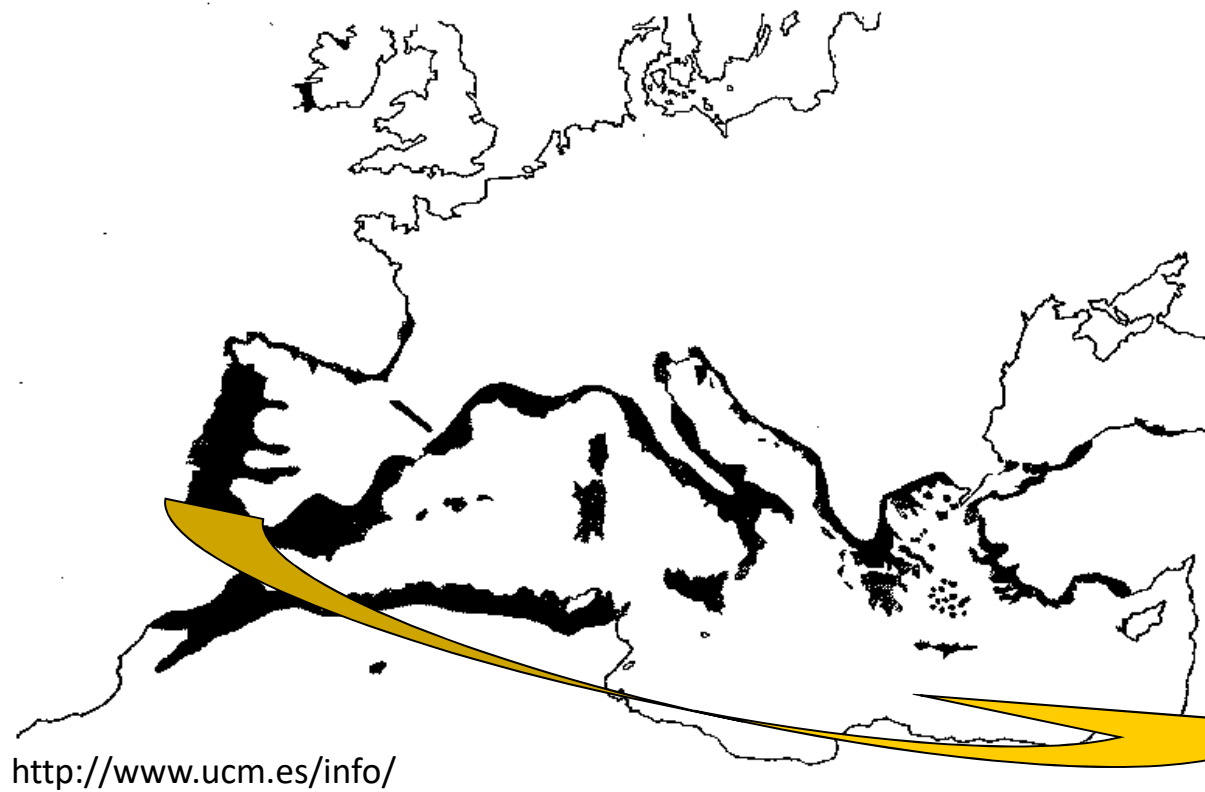
R. L. Pato, G. Botelho, J. Franco, S. Santos, P. Figueiredo, J. Gama, F. Gomes



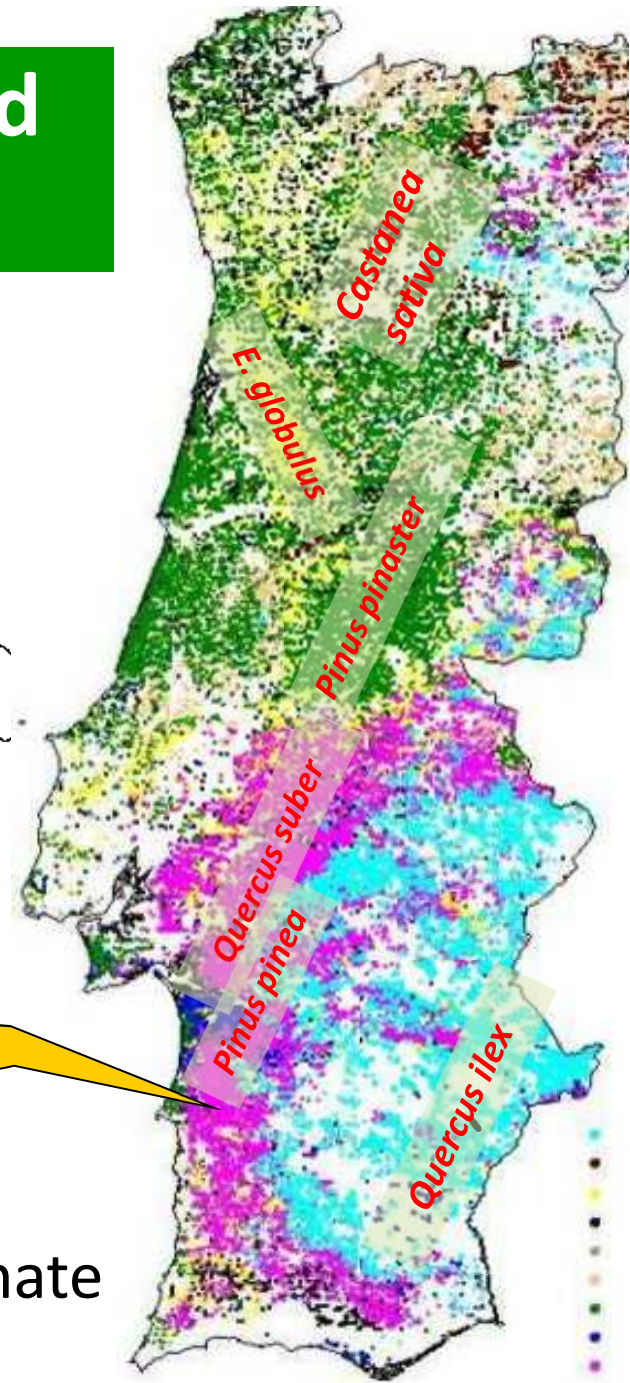
Projeto: PDR2020-784-042742 RG-PCMG-Medronheiro



Arbutus unedo L. in Europe and Portugal



Native species of Mediterranean climate





Medronheira



New products



Praline
(Sugar Bloom, 2013)

Pâtés handmade fruit
(Sugar Bloom, 2013)



Jellified for *Arbutus*
(Sugar Bloom, 2013)



Dried and Lyophilized
(ESA Beja)



Farming type: natural regeneration vs orchards

Vegetal material: seedlings vs clonal plants



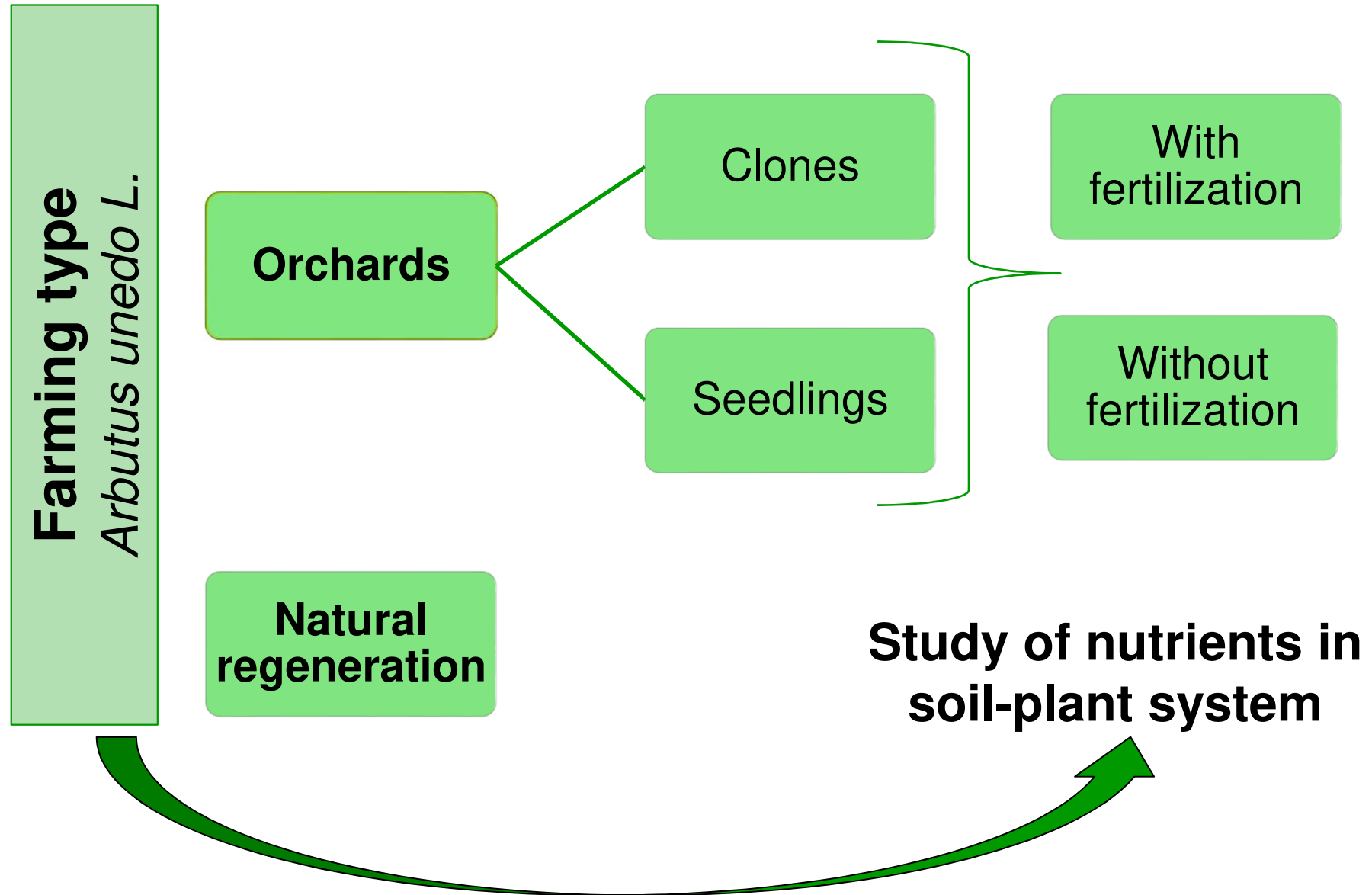
Orchards with 7 years (5mx5m and 5mx3m)

Interest of forest producers
in the economic valorization
of the species

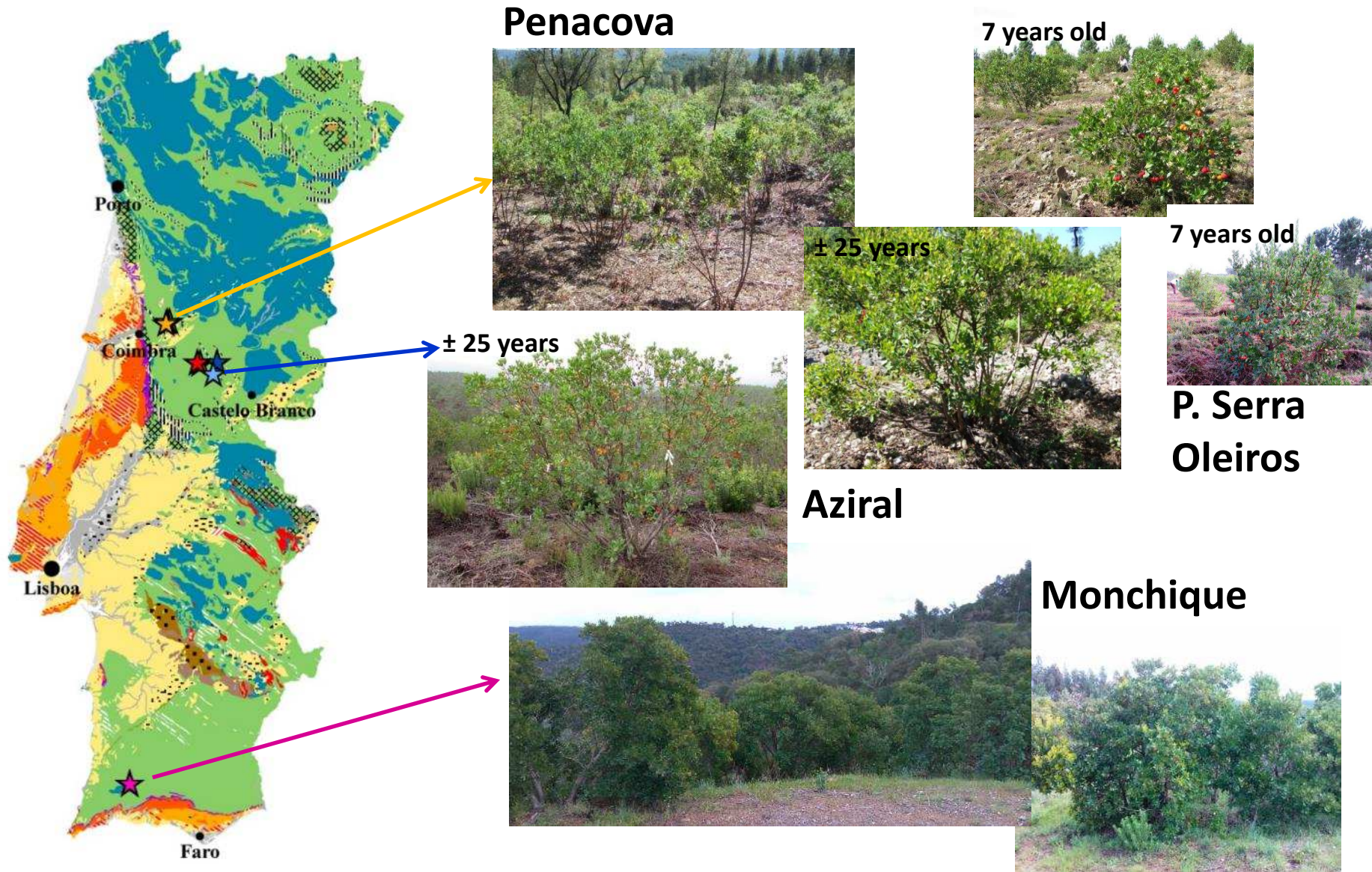
New orchards:
Seedlings or Clones



THE NUTRIENTS IN THE SOIL-PLANT SYSTEM



EXPERIMENTAL AREAS: NATURAL REGENERATION AND ORCHARDS



NUTRIENT CYCLE SOIL-PLANT SYSTEM



Leaves



Plant



Fruit

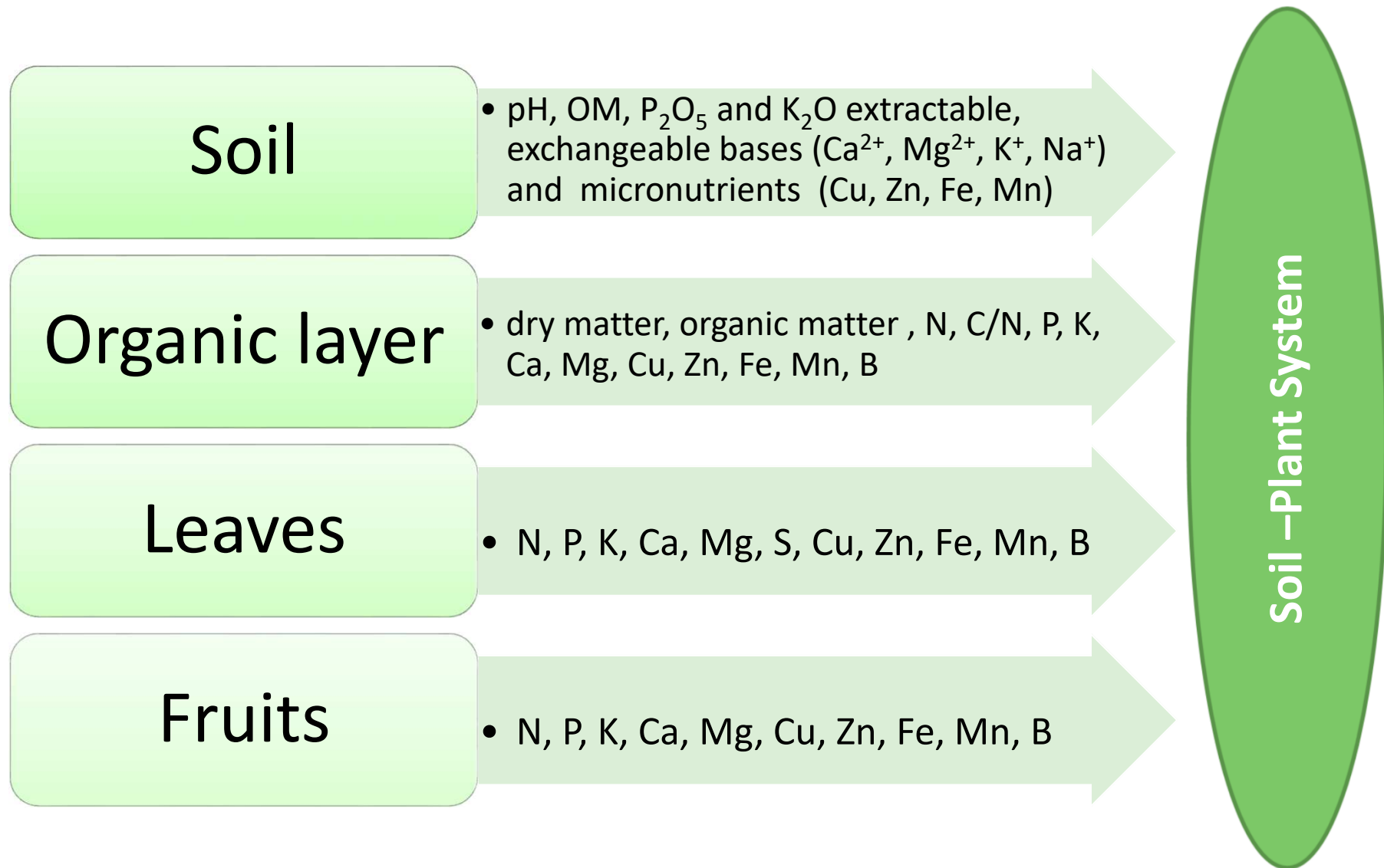


Organic layer



Soil

SOIL LABORATORY ANALYSIS



FRUIT PRODUCTION & QUALITY ANALYSIS

Fruit weight



Total soluble solids (TSS/Brix)



Acidity



Reduced and total sugars



Fruit Production & Quality

SOIL: CAMBISOLS AND LEPTOSOLS FROM shale rock

Centre Region

acid pH (5,3)

high organic matter (4,9%)

very low P_2O_5 (2,00 mg kg⁻¹)

medium content of extractable K_2O (87 mg kg⁻¹) and K^+ (0,21 me 100g⁻¹) and very low Ca^{2+} (0,79 me 100g⁻¹) and Mg^{2+} (0,32 me 100g⁻¹)

variable contents of extractable micronutrients (Cu, Zn, Fe, Mn)

low Zn (0,84 mg kg⁻¹) and very high Fe (124 mg kg⁻¹)



SOIL: LUVISOLS FROM CLAY SHALE

South: Monchique

neutral pH (6,7)

very high level of organic matter (19,1%)

very low extractable P_2O_5 (11 mg kg⁻¹)

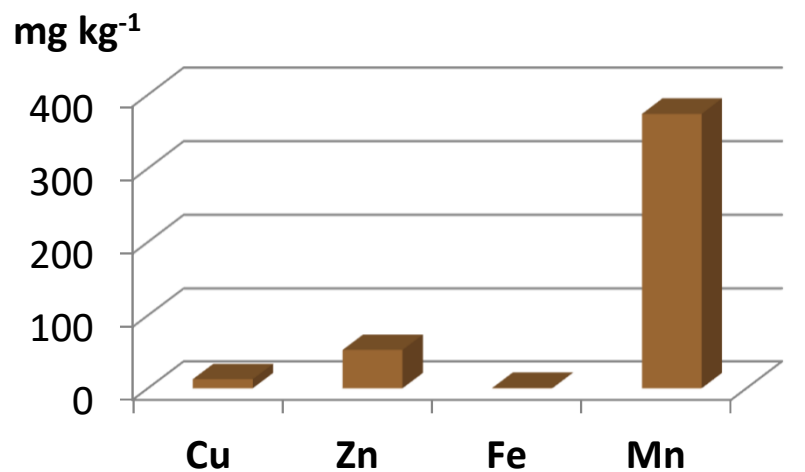
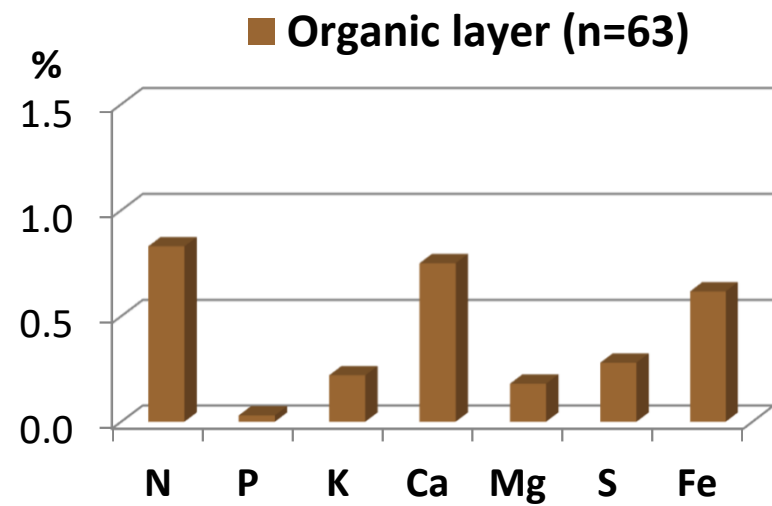
very **high content** of extractable K_2O (200 mg kg⁻¹) and K^+ (1,30 me 100g⁻¹), **high** Ca^{2+} (15,2 me 100g⁻¹) and Mg^{2+} (3,44 me 100g⁻¹)

Variable contents of extractable micronutrients:

- Average content Cu (0,95 mg kg⁻¹)
- High content Zn (8,79 mg kg⁻¹)
- Very high content Fe (186 mg kg⁻¹) and Mn (102 mg kg⁻¹) extractable

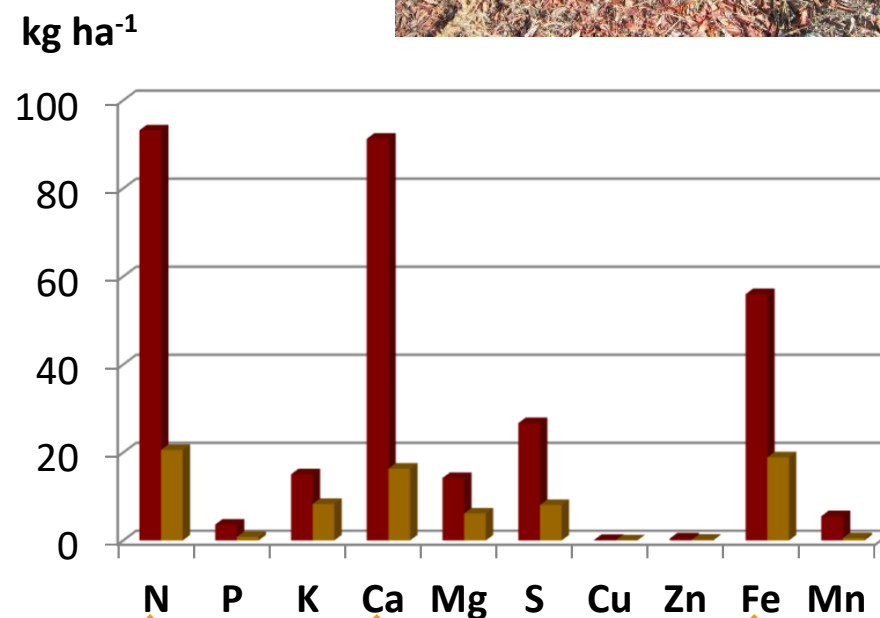


NUTRIENTS IN ORGANIC LAYER



nutrients

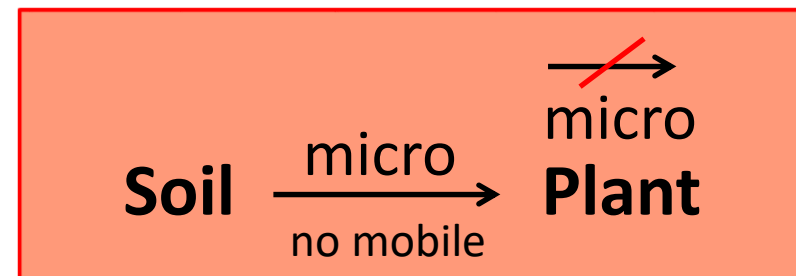
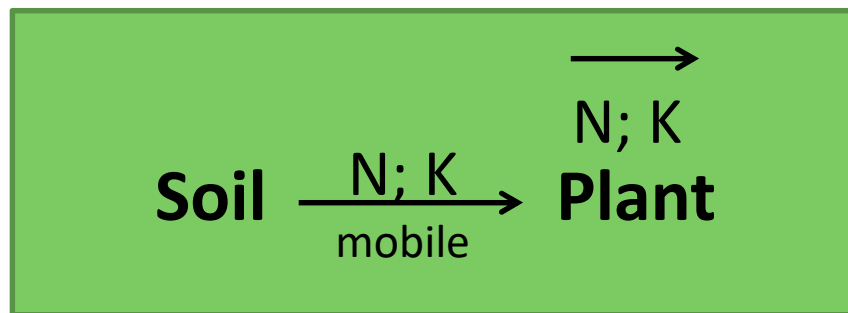
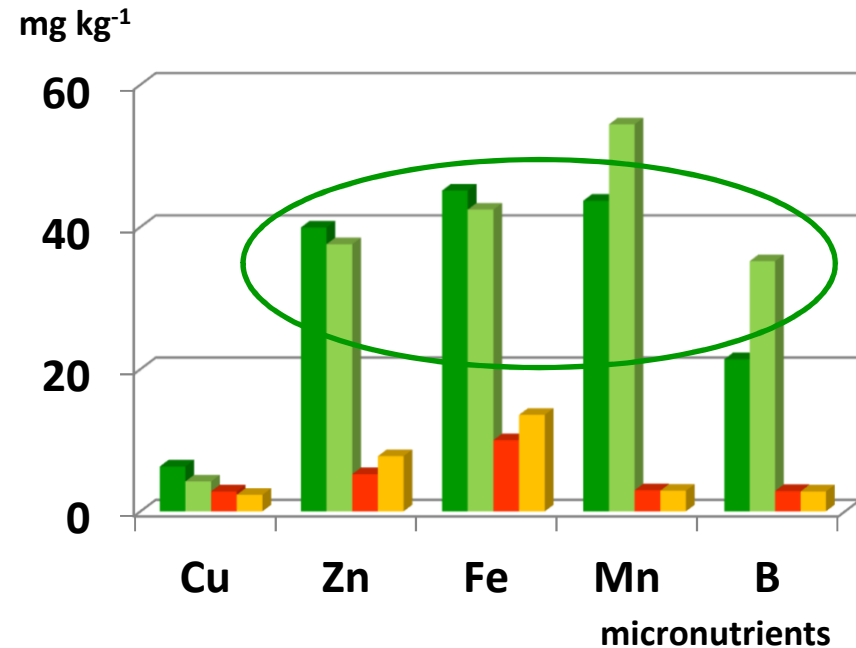
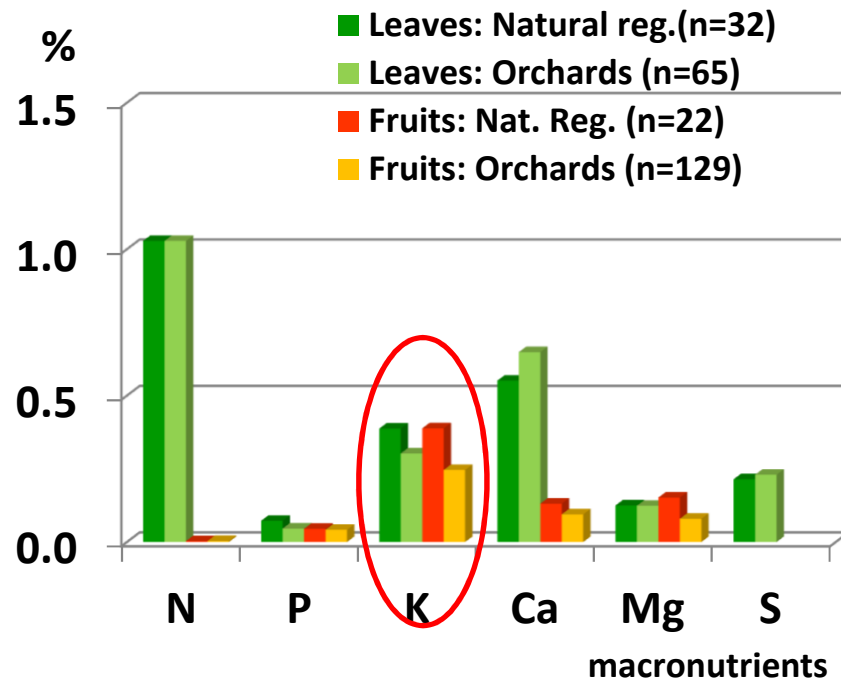
Soil covered
with 12 cm of
organic layer



■ Nat. Regen. (samples: 30; mean: 9,51 ton ha⁻¹; C/N= 44)

■ Orchards (samples: 33; mean: 2,94 ton ha⁻¹; C/N=57)

NUTRIENTS IN LEAVES AND FRUITS



FRUIT PRODUCTION AND NUTRIENTS EXPORT

Experiment	Area	Prod.	Production
	(m ²)	(kg)	(kg ha ⁻¹)
Seedlings	1920	10,43	54,32
Seedlings	256	7,62	97,73
Nat. Reg. Cen	*	23,85	496,78
Clonal Plants	1920	163,84	868,95
* 30 plants			

Clones show higher Fruit Production than seedlings
 $\Rightarrow$ Export more nutrients

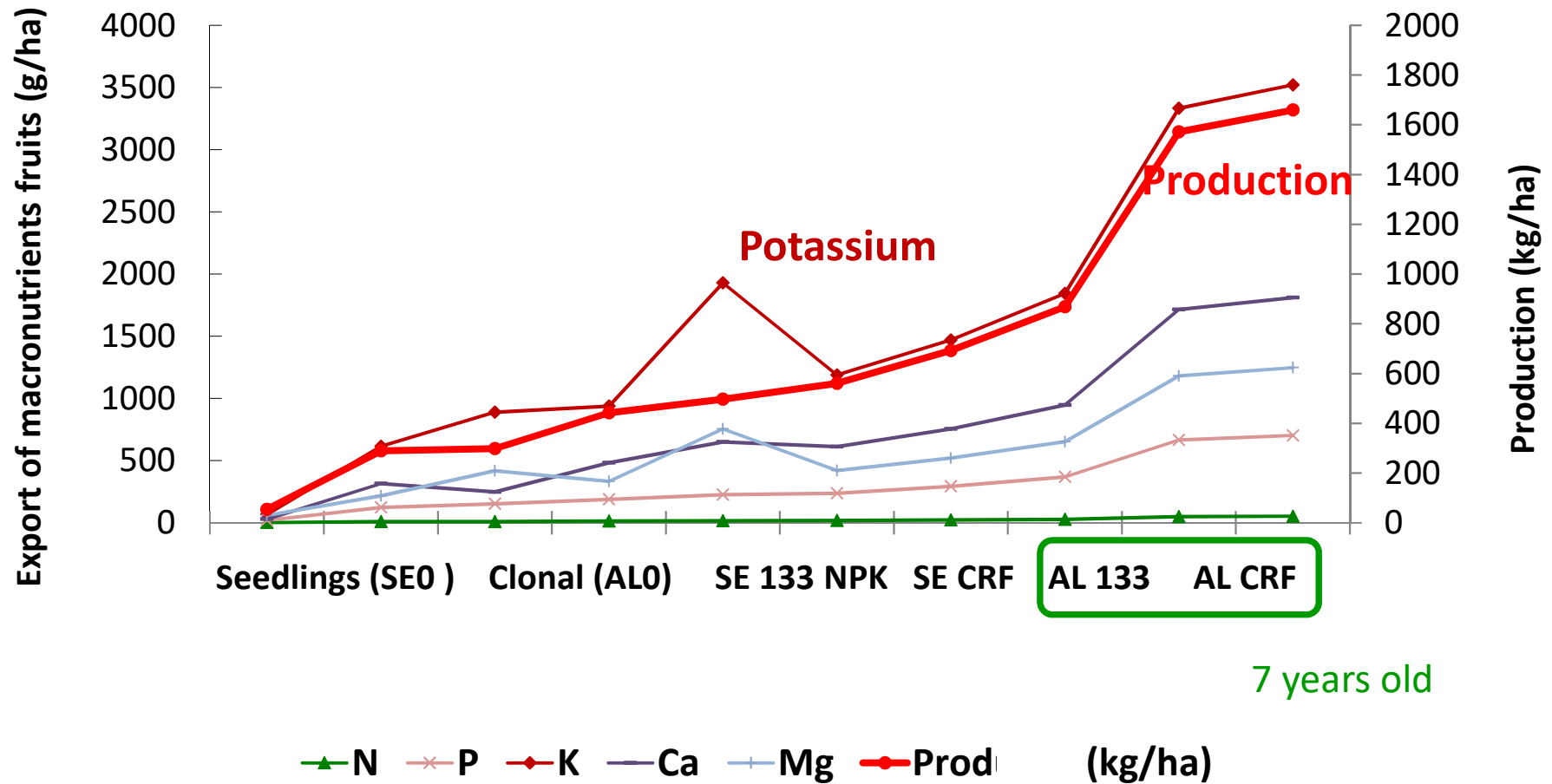
In fruits:

K > Ca > Mg > N > P > Fe > Zn

Experiment	Nutrient export (g ha ⁻¹)									
	N	P	K	Ca	Mg	Cu	Zn	Fe	Mn	B
Seedlings	1,95	19,8	67	28,8	60,4	0,11	0,5	0,79	0,15	0,15
Seedlings	9,91	153	888	248	417	0,71	2,53	5,48	0,9	0,96
Nat. Regen.	16,1	225	1928	651	755	1,39	2,6	4,97	1,47	1,42
Clonal Plants	28	368	1844	948	653	2,26	6,63	10,9	2,43	2,7

ORCHARD PRODUCTION AND EXPORT OF MACRONUTRIENTS

Vegetal material: Seedlings (SE) vs Clonal plants (AL)
Fertilization: 0 vs 133 (7:21:21) vs CRF (9:23;14 +4 +0,1 MgO B)

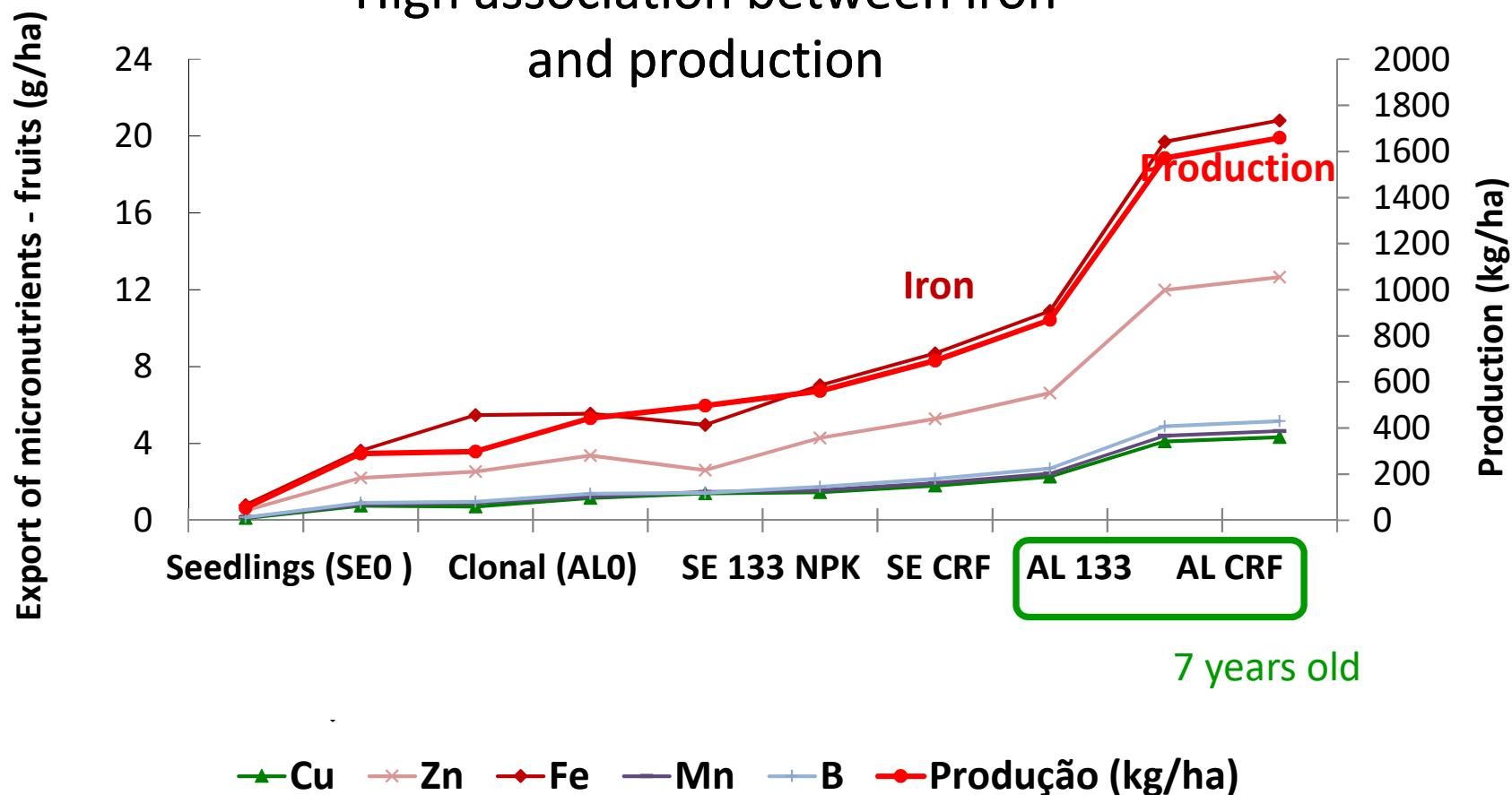


ORCHARD PRODUCTION AND EXPORT OF MICRONUTRIENTS

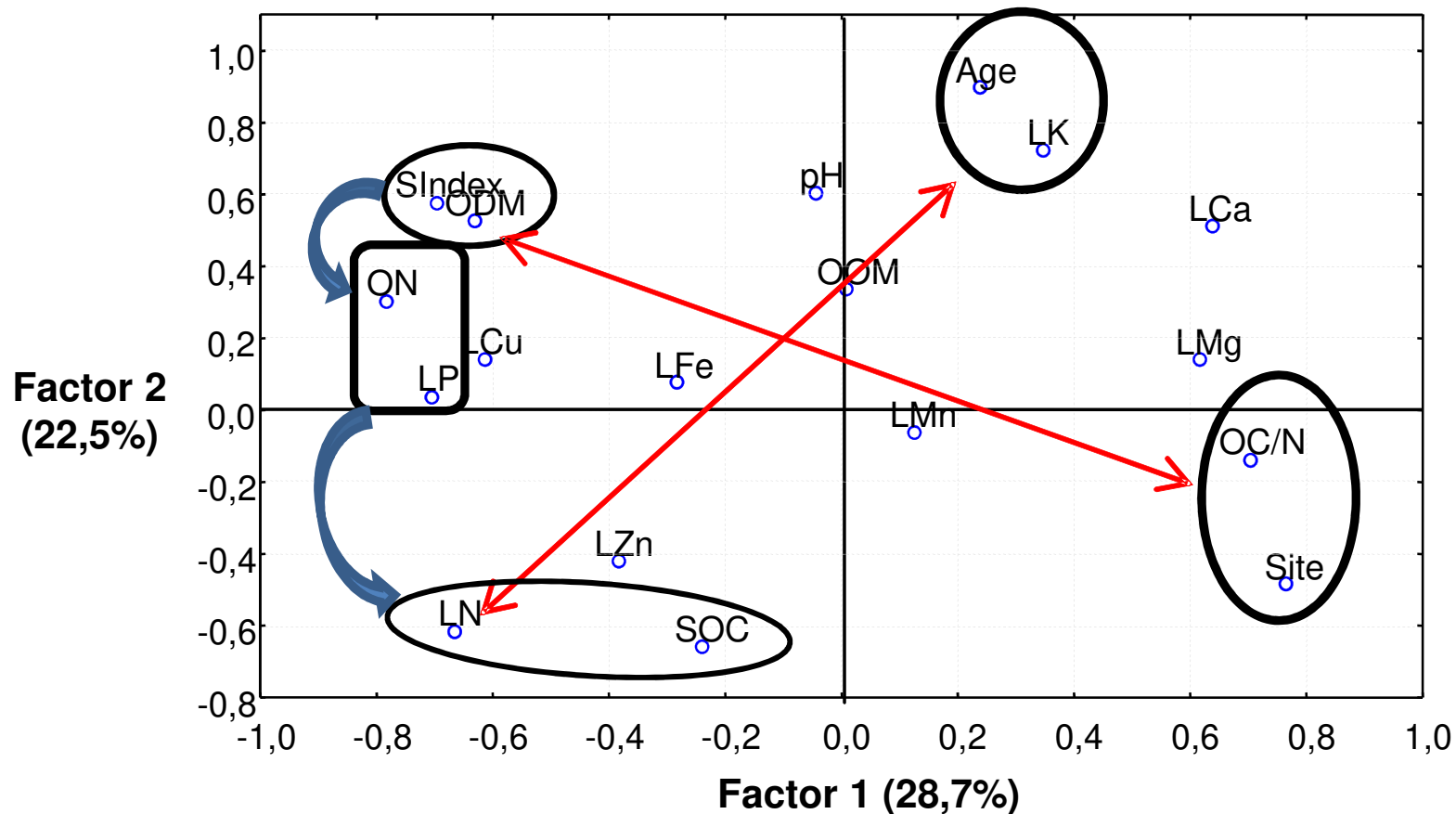
Orchard: Seedlings (SE) vs Clonal plants (AL)

Fertilization: 0 vs 133 (7:21:21) vs CRF (9:23;14 +4 +0,1 MgO B)

High association between iron
and production



SOIL-PLANT SYSTEM

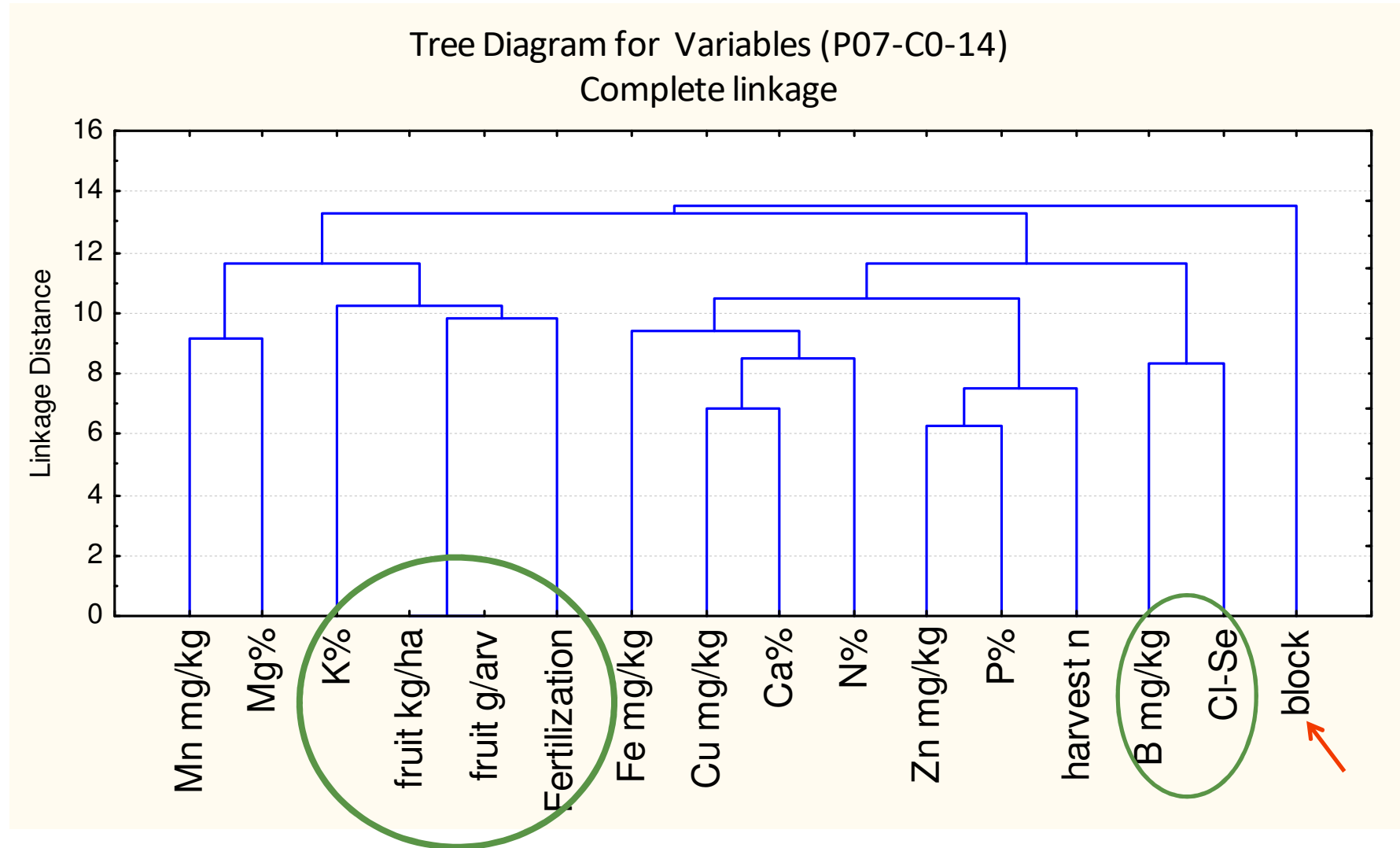


Site index $\leftrightarrow$ plant vigor $\leftrightarrow$ production of organic layer; higher nitrogen content and lower C/N ratio; higher P & N content in leaves

A higher content of organic carbon in soil promotes a higher N content in leaves

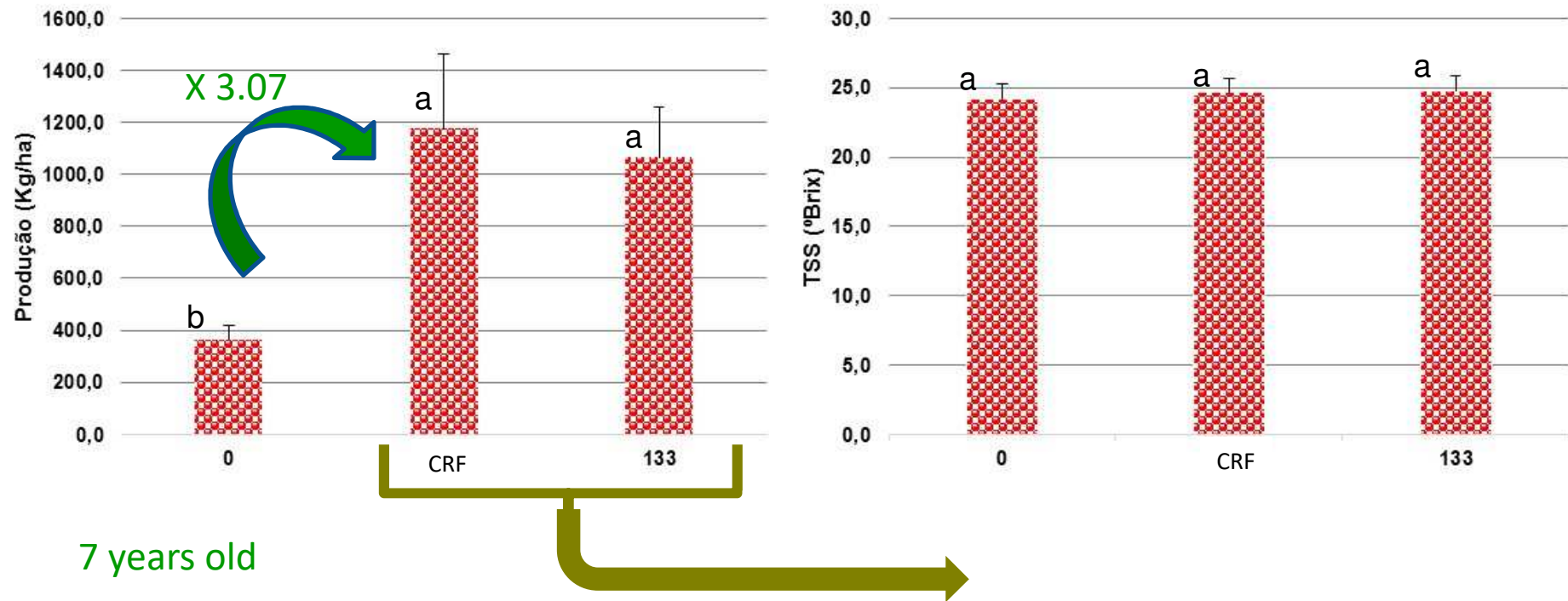
Older plants have leaves with a lower N content and higher content of K

ORCHARD PRODUCTION AND NUTRIENTS IN THE FRUIT



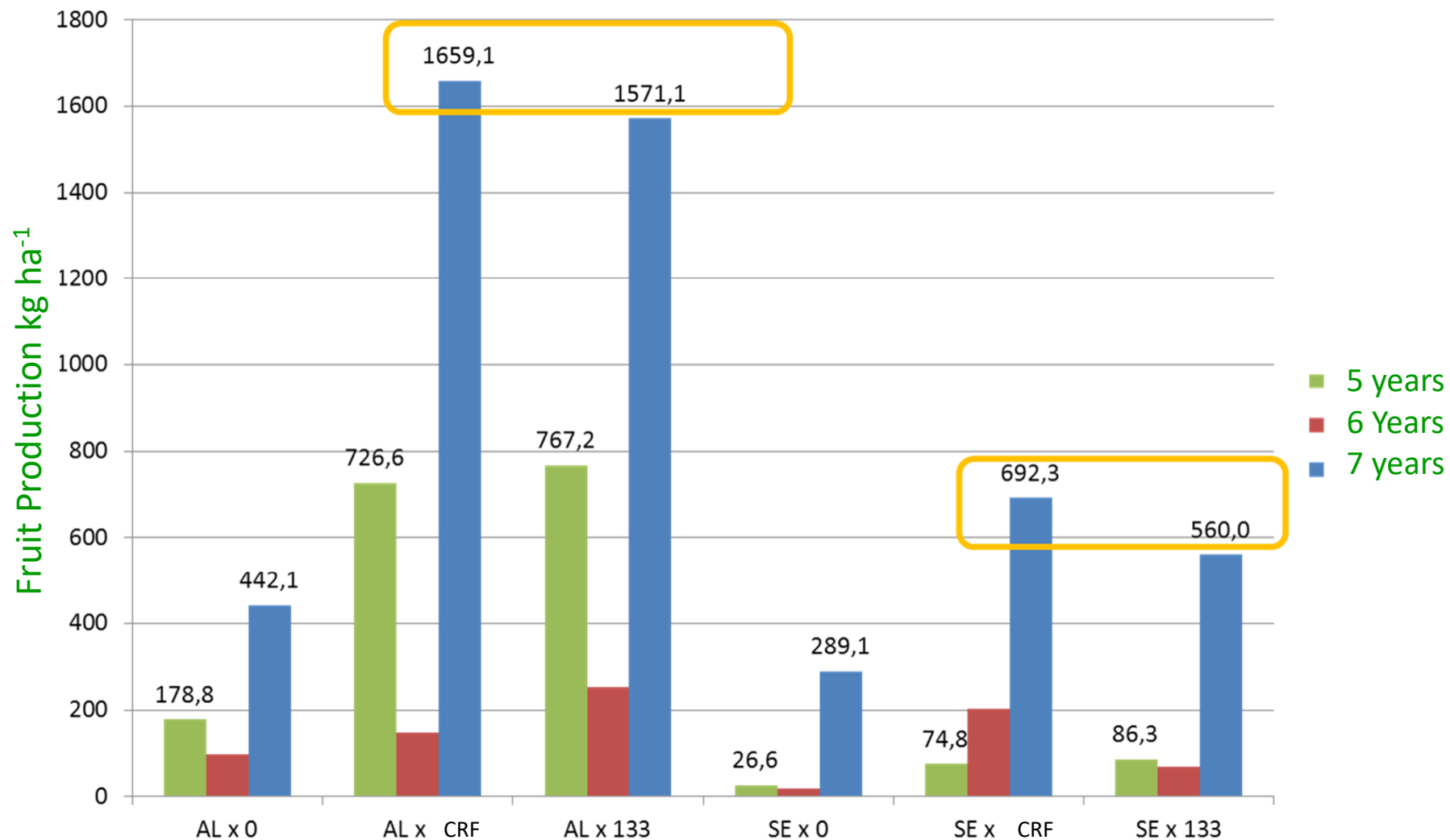
Cluster analyses for the trial: seedlings & clonal; fertilization

ORCHARD FERTILIZATION ON FRUIT PRODUCTION & QUALITY



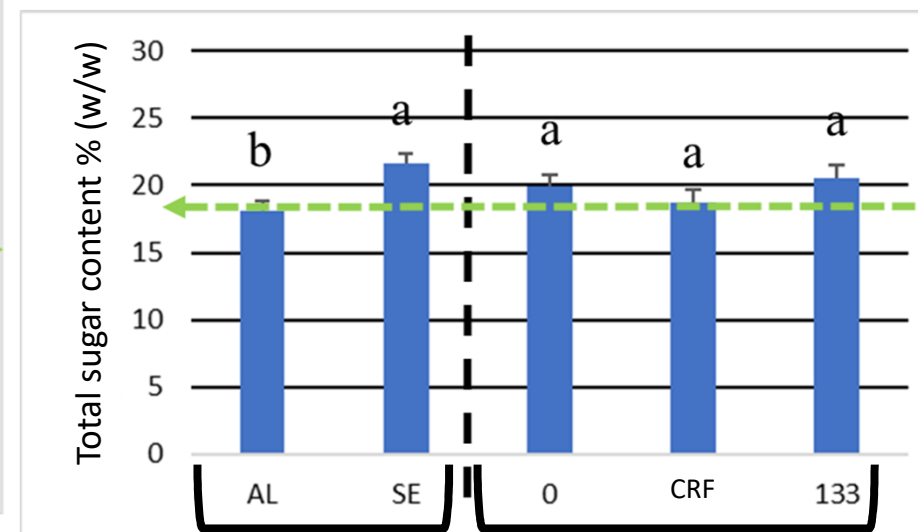
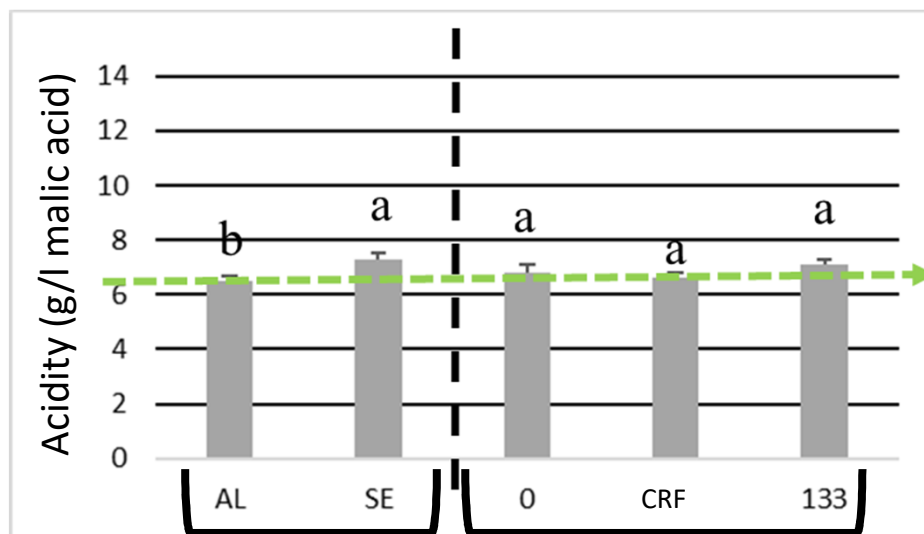
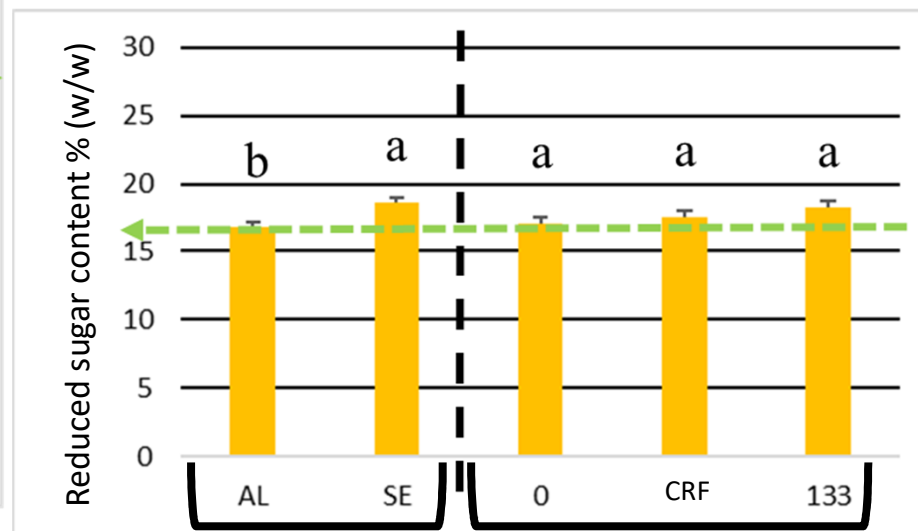
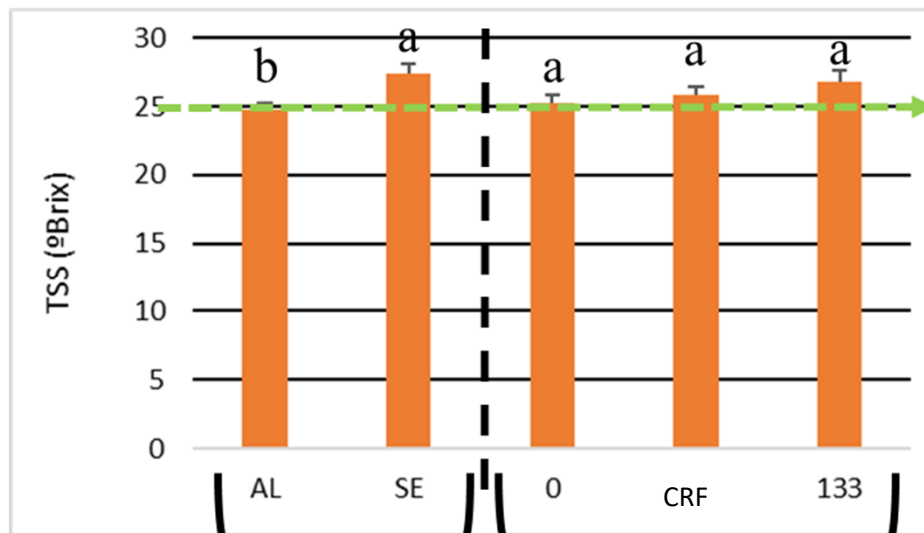
Higher productivity <> Similar Quality

INTERACTION OF FERTILIZATION X VEGETAL MATERIAL ON FRUIT PRODUCTION (5-7 YEARS OLD ORCHARD)



FERTILIZATION & VEGETAL MATERIAL ON FRUIT QUALITY

7 years old



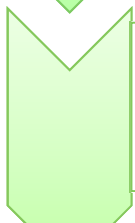
Higher production successively observed with clonal plants, it will be convenient to improve soil fertility

Final Considerations



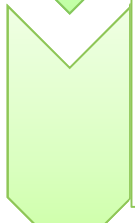
- Nutrients in **leaves**: **N>Ca>K>**S>Mg>P>Mn>Fe>Zn>B>Cu

- Extraction by **fruits**: **K>Ca>Mg>**P>N>Fe>Zn>B, Mn, Cu



- Promote and **maintain** the **organic residues on soil**

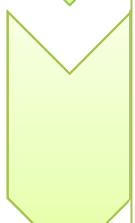
- Select **clones** adapted to the **agro-ecological conditions**



- **Clonal plants** with greater **productive potential** showed a better **response to fertilization**



- **Perform fertilization** while **planting** and **afterwards** compensate the **nutrients extraction by fruit**.



- **At plantation**, fertilization with **P₂O₅ & K₂O** improved the **root system development**; its effect on fruit production was noted on 7 years old plants

Perspectives for future studies

- 
- Define the most **appropriate** time for leaves harvesting to assess **the crop nutritional status**
 - Establish the relationships among: a) **leaves nutrient content**; b) **nutrient** content in **fruits** and c) **production**
 - Assess a **suitable range** for **leaves nutrients** to achieve the highest production potential and
 - **leaf reference values** to optimize **production** and to support a **fertilization program**

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Thank you for your attention!



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Escola Superior
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