CAPACITY OF CO_2 FIXATION OF MURCIAN CROPS

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(CSIC)

- **Introduction**
- **Methodology applied**
- **Results**
- **Conclusions**

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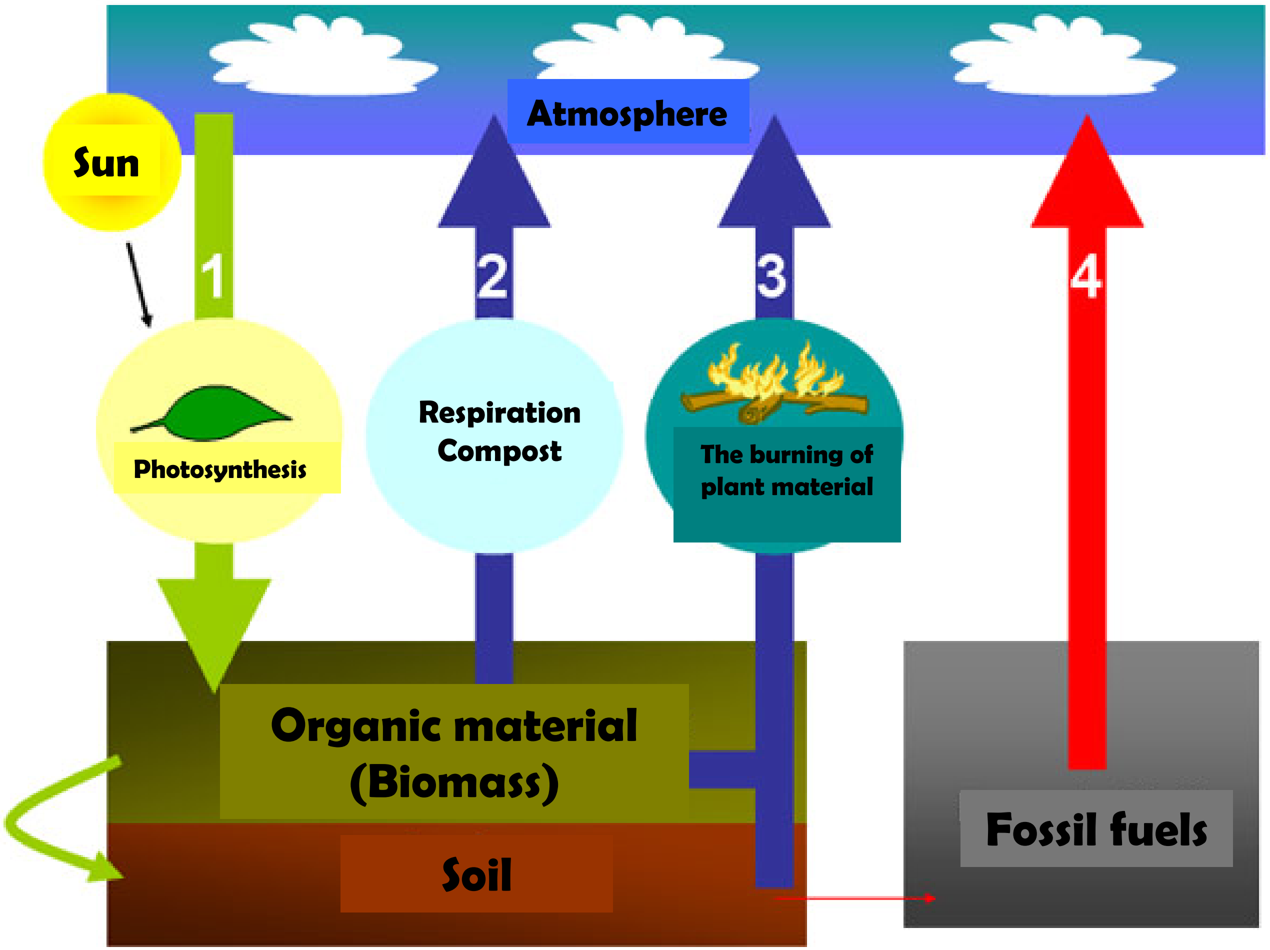
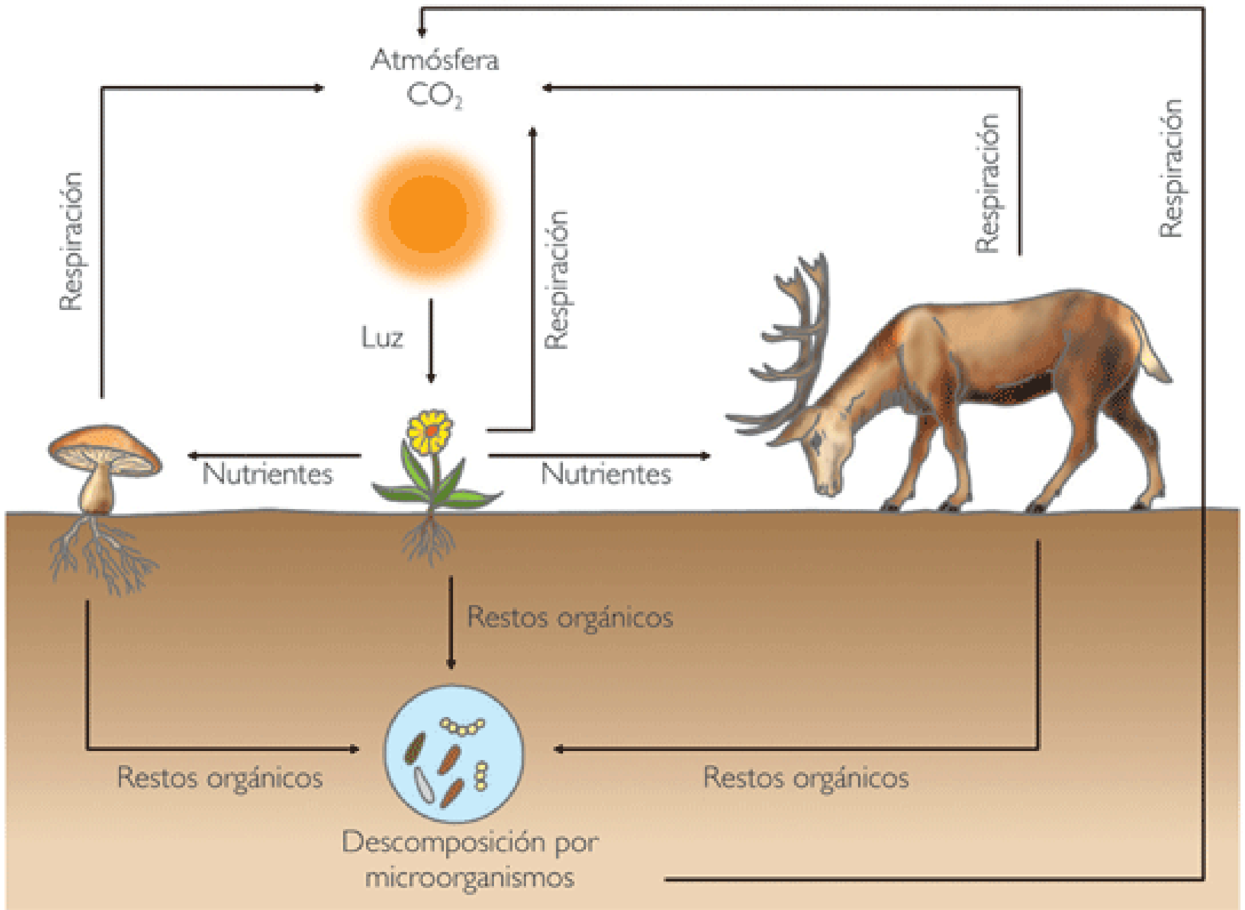
Atmospheric CO_2



El CO_2 atmosférico



El suelo

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Institution of MECHANICAL ENGINEERS

Prediction that 100,000 ARTIFICIAL TREES in 2050 will absorbe 330 mT of CO_2 emissions.

(Image: artificial trees in the North Sea and IMechE's artist impression of UK in 2060)

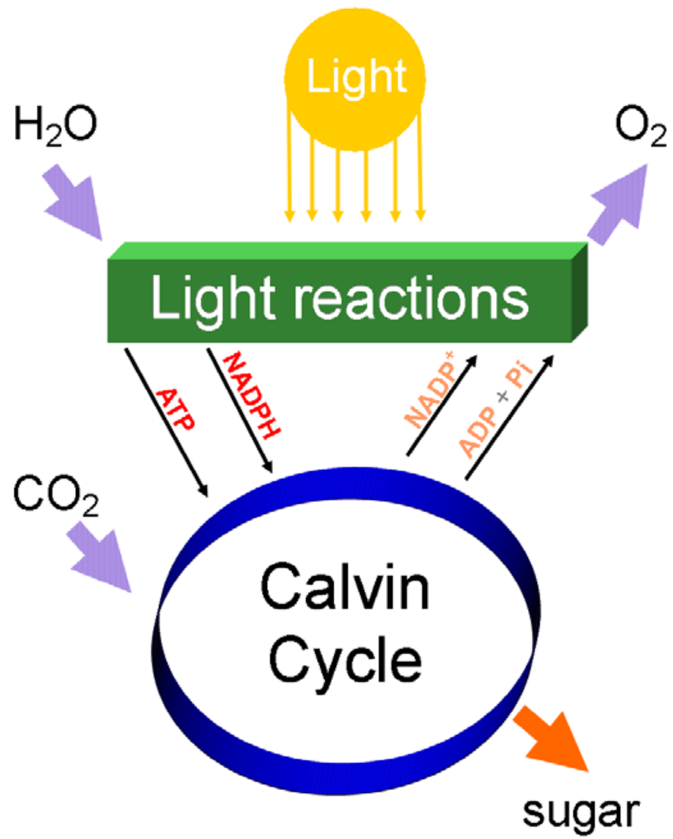
conocer

» HISTORIA | CIENCIA | SALUD | TECNOLOGÍA | PREGUNTAS Y RESPUESTAS | NATURALEZA...

¿Serán así los árboles del futuro?

Puede que sí, y antes de lo que imagina. Si se cumplen los planes de un equipo de científicos de la londinense Institution of Mechanical Engineers, en 10 o 20 años estos extraños 'matamoscas gigantes' podrían formar parte del paisaje. Son 'árboles artificiales' diseñados para atrapar el dióxido de carbono de la atmósfera: un 'bosque' de 100.000 ejemplares podría absorber las emisiones producidas por el transporte en el Reino Unido. Eso sí, no son la panacea: la solución pasa por reducir la contaminación. ■ D. M.

Photosynthesis



First stage

$$H_2O + NADP^+ + Pi + ADP \xrightarrow{\text{luz}} O_2 + H^+ + NADPH + ATP.$$

Second stage

$$CO_2 + NADPH + H^+ + ATP \longrightarrow GLUCOSA + Pi + NADP^+ + ADP$$

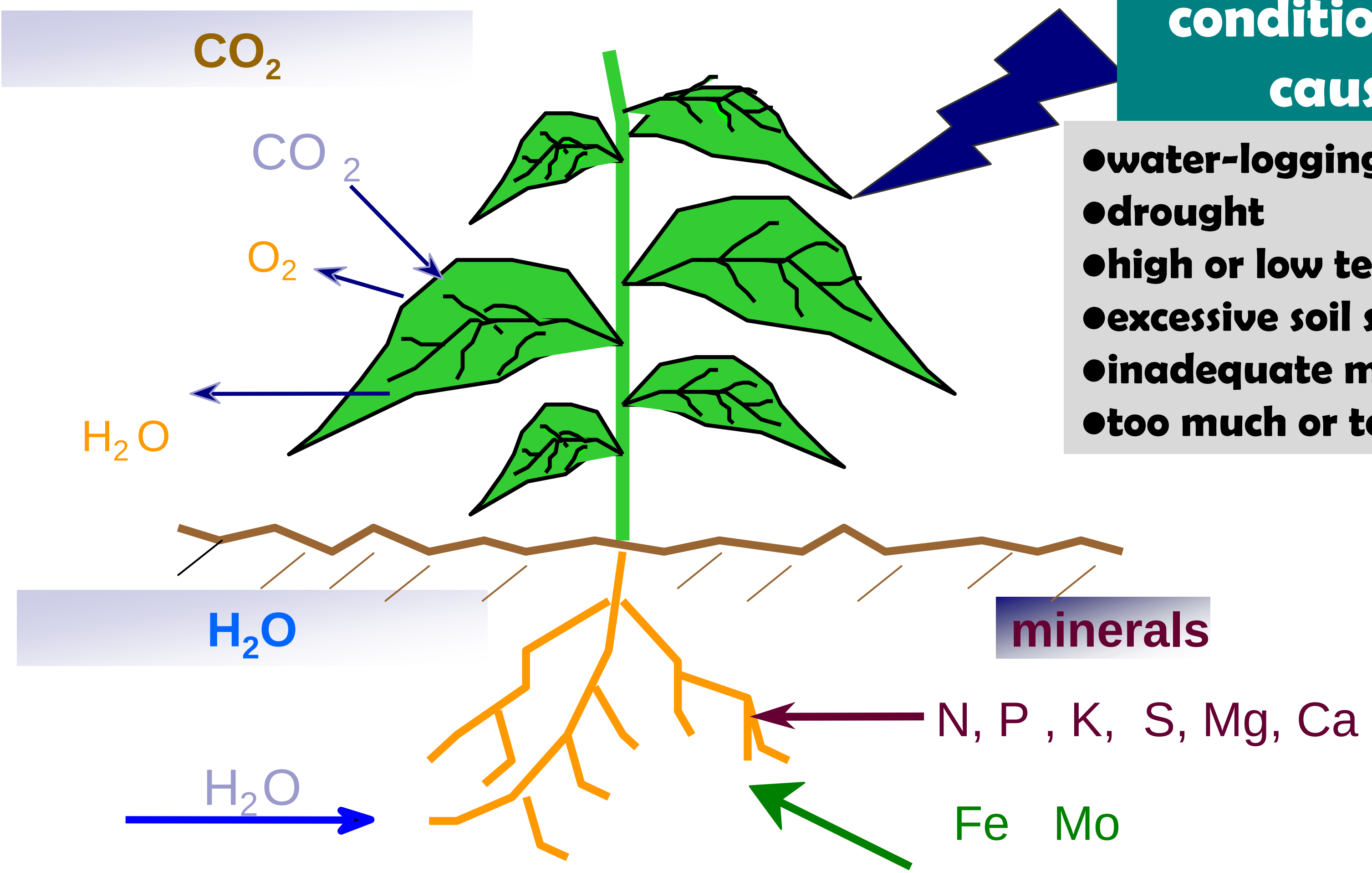
Different CO_2 fixations

Plants C-3: Stomata opened during daylight for CO_2 , fixation. This fact produces a continue water loss by transpiration.

Plants C-4: Stomata opened during daylight . They have got CO_2 pump intermediaries in cells that allow stomata closing and continue photosynthesis .

Plants CAM: Stomata opened during night . Reduction of water loss by transpiration. They have got CO_2 pump intermediaries as pool.

ABIOTIC STRESS



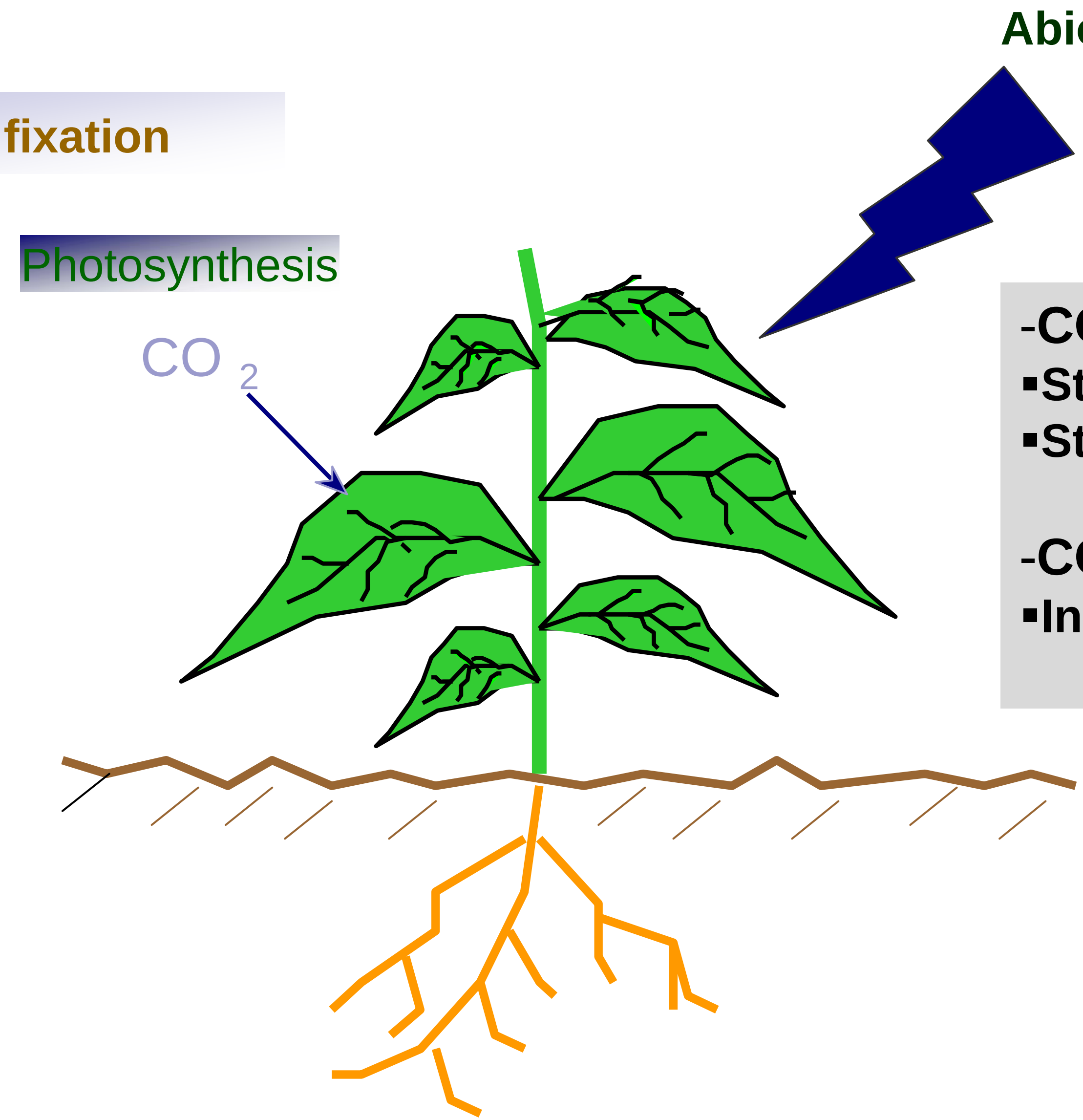
Environmental conditions that can cause stress

- water-logging
- drought
- high or low temperatures
- excessive soil salinity
- inadequate mineral in the soil
- too much or too little light

↓ Growth ↓ Yield

CO_2

CO_2 fixation



-CO_2 fixation →

- **Stomata open.**
- **Stomatal conductivity**

-CO_2 diffusion→

- **Internal conductivity**

Murcian agriculture

Excellent climatic conditions - High productivity

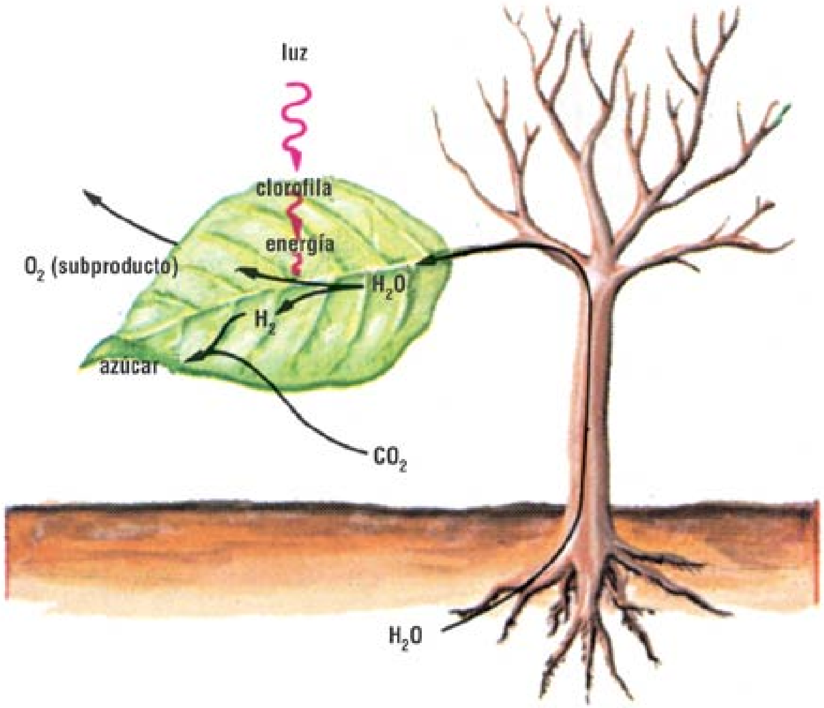
Non limiting factors – Optimisation of resources

Good crop practices - Sustainability of farms management




OBJECTIVE

In this scientific work the rate of CO_2 fixation has been determined in the more important crops in Region of Murcia.



- Crops whose irrigation surface > 1000 Ha

- Rate of CO2 fixation has been calculated based in:

  - Annual biomass.
  - Carbon content in tissues

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Material vegetal y procesado

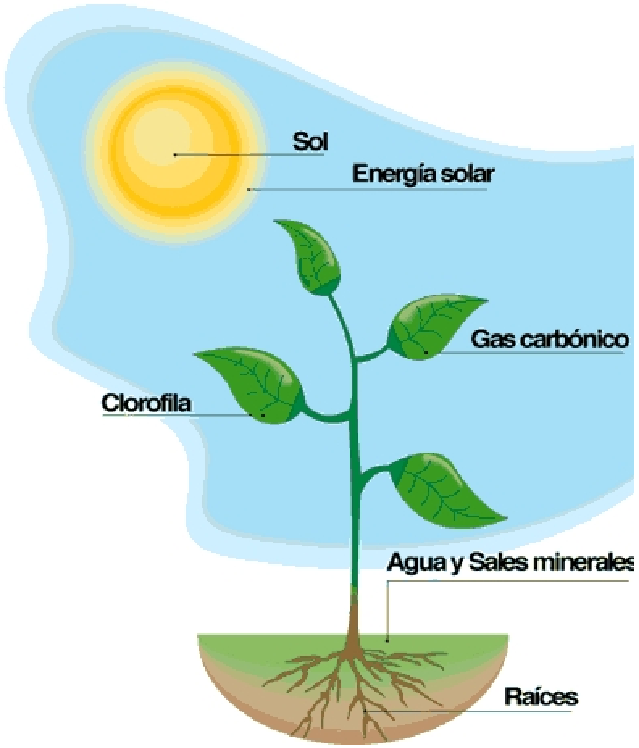
CO_2 fixation

Production of annual biomass:

Plant → Shoot (fruit)

Three → Root

Total carbon was analysed from annual biomas



Horticultural plants

Tomato, pepper, watermelon, melon, lettuce and broccoli

- Three plants of each specie was collected at the end of their growing cycle.
- Fruits, leaves, stems and roots were separated and weighed to determine their fresh weight.
- They were introduced in a hot air oven at 70 ° C until constant weight to determine dry weight.
- They were ground in a laboratory mill,
- Carbon was measured.

Fruit trees

Apricot, plum, peach, nectarine and table grape

- Three trees of each species were collected after fruit harvesting
- Leaves, annual stems and annual roots were separated and weighted to determine their fresh weight per year.
- The trunk and on annuals branches were weighed and divided by n-years to determine their annual fresh weight.
- Fruit samples were taken separately.
- A representative sample were introduced in a hot air oven at 70 ° C until constant weight to determine dry weight.
- They were ground in a laboratory mill..
- Carbon was measured.

Citrus trees

lemon, orange and mandarin

- Three trees of each species were uprooted

- Leaf, non-wood branch and root were separated and weighted to determine their fresh weight. For calculating of total carbon captured per tree and per year, it was found that leaf biomass is renewed every 3 years.

- The trunk and on annuals branches were weighed and divided by n-years to determine their annual fresh weight.

- Fruit samples were taken.

- A representative sample were introduced in a hot air oven at 70 ° C until constant weight to determine dry weight.

- They were ground in a laboratory mill.

- Carbon was measured.

Hot air oven at 70ºC

Carbon analyzer

Total carbon content was measured in sub-samples (about 2-3 mg PS) of leaves, stems, fruits and roots with an N-C analyzer.

NC analyzer-Thermo Finnigan 1112 EA. Basic Analizer (Thermo Finnigan-, Milán, Italia).

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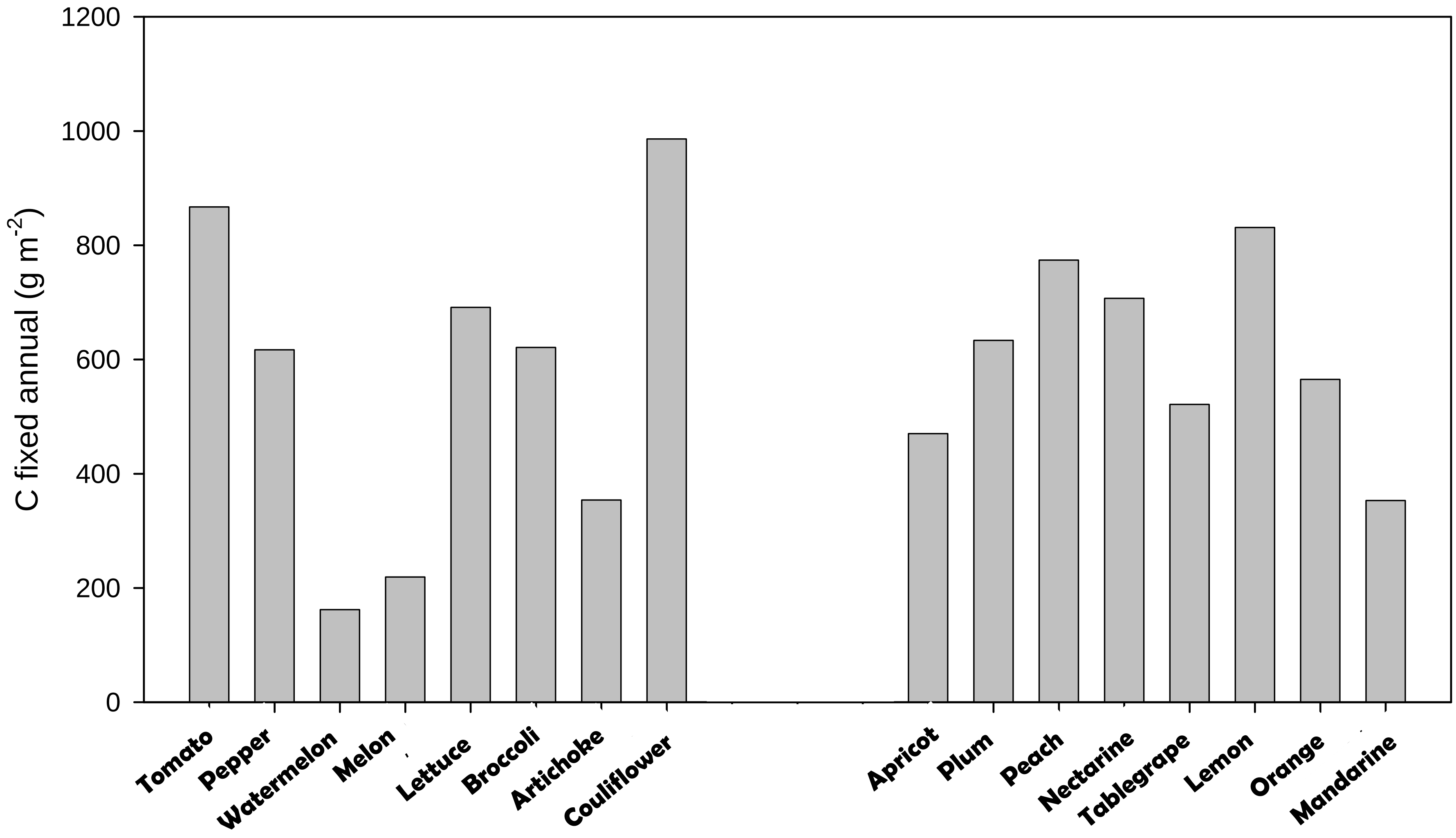
Tables of results

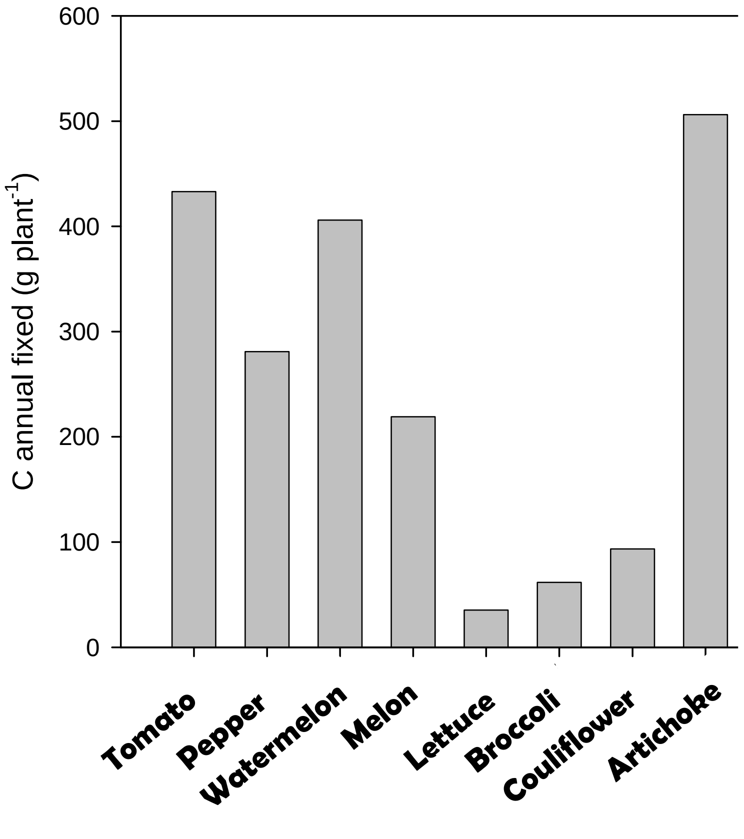
TOMATO	Fresh weight	Dry weight	Humidity	%C	Total C	Total C	TOTAL PLANT	
	(g plant^{-1})	(g plant^{-1})	%	(% D.W.)	(g m^{-2} year^{-1})	(T ha^{-1} year^{-1})	g C Plant^{-1}	g CO_2 Plant^{-1}
Root	134	22,5	83,23	38,96	17,5	0,2	8,8	32,3
Stem	1.434	296,8	79,30	40,36	240	2,4	120	440
Leaves	866	169,7	80,40	40,99	139	1,4	69,6	255
Fruit	3.394	510,8	84,95	46,05	470,4	4,7	235,2	862
Total	**5.827**	**1.000**			**867**	**8,7**	**433**	**1.590**

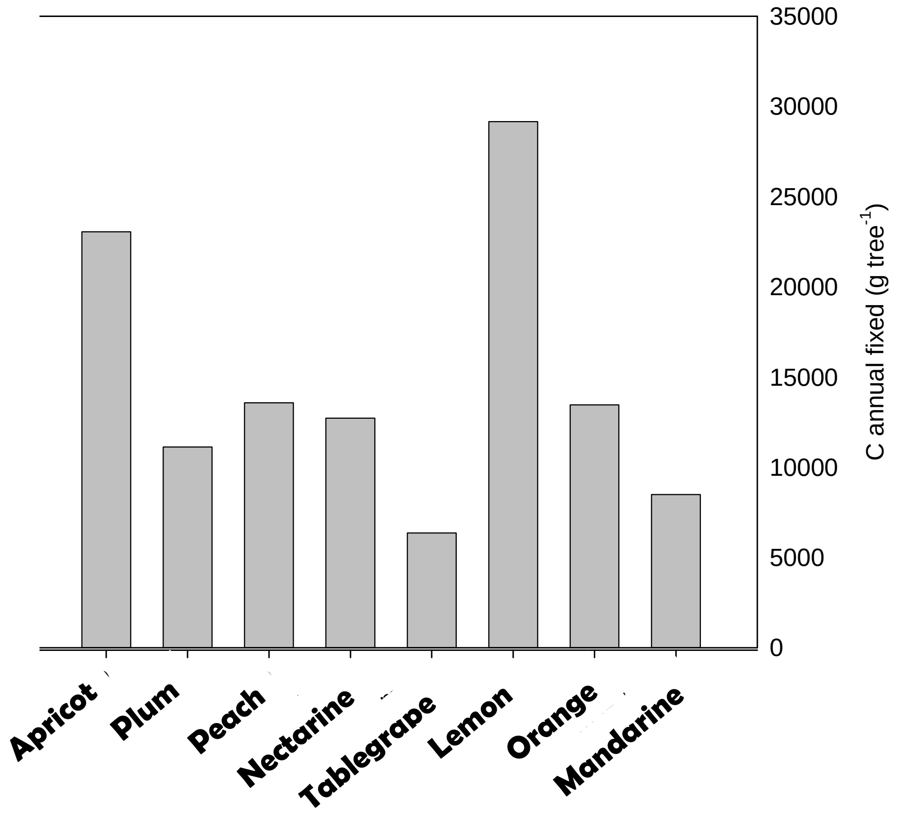
APRICOT TREE	Fresh weigth	Dry weight	Humidity	%C	Total C	Total C	TOTAL TREE	
	(g tree^{-1})	(g tree^{-1})	%	(% dry weight)	(g m^{-2} year^{1})	(T ha^{-1} year^{-1})	g C tree^{-1}	g CO_2 Tree^{-1}
Root	25.217	15.130	40,00	43,04	132,8	1,3	6.512	23.870
Branches	10.185	6.057	40,53	46,74	57,8	0,6	2.831	10.381
Leaves	12.081	5.074	58,00	45,13	46,7	0,5	2.290	8.396
Fruits	125.000	18.588	85,13	64,5	174,3	1,7	8.545	31.331
Trunk	10.297	6.134	40,53	46,74	58,5	0,6	2.867	10.512
Total	**182.780**	**50.983**			**470,1**	**4,7**	**23.045**	**84.498**

Total annual Carbon fixed by each crop express by surface units (m^2)



Total annual Carbon fixed by each crop express by plant or tree



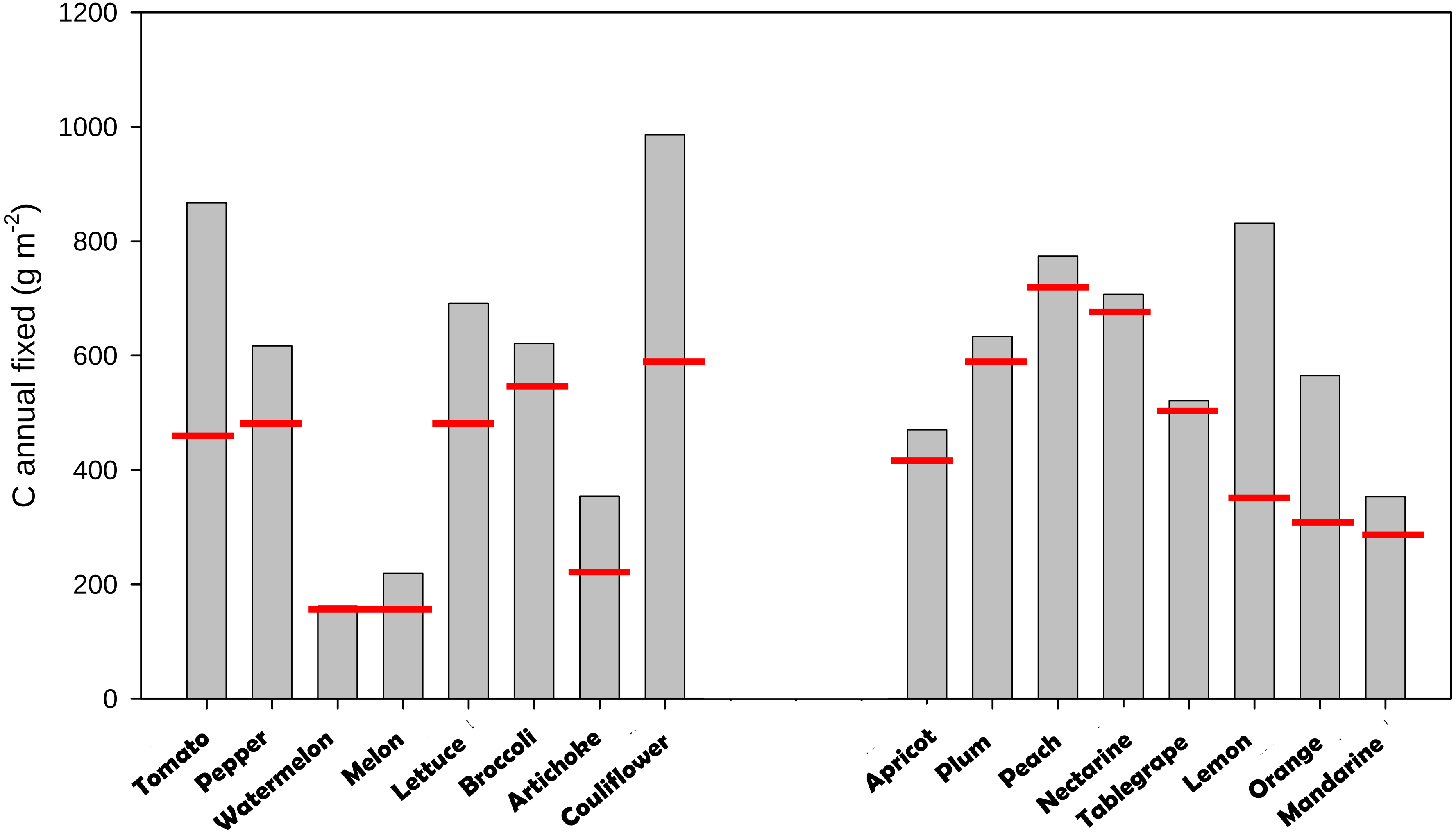


Total Carbon (%) accumulated in soils in each of the studied crop field

Type of soil	C TOTAL (%)
Horticultural crops	6.05
Cereals	6.36
Fruit trees	7.15
Citrus	7.13
Non crop fields	5.77
Pathways	5.79

Samples taken at 30 cm from the surface

Comparison with literature results



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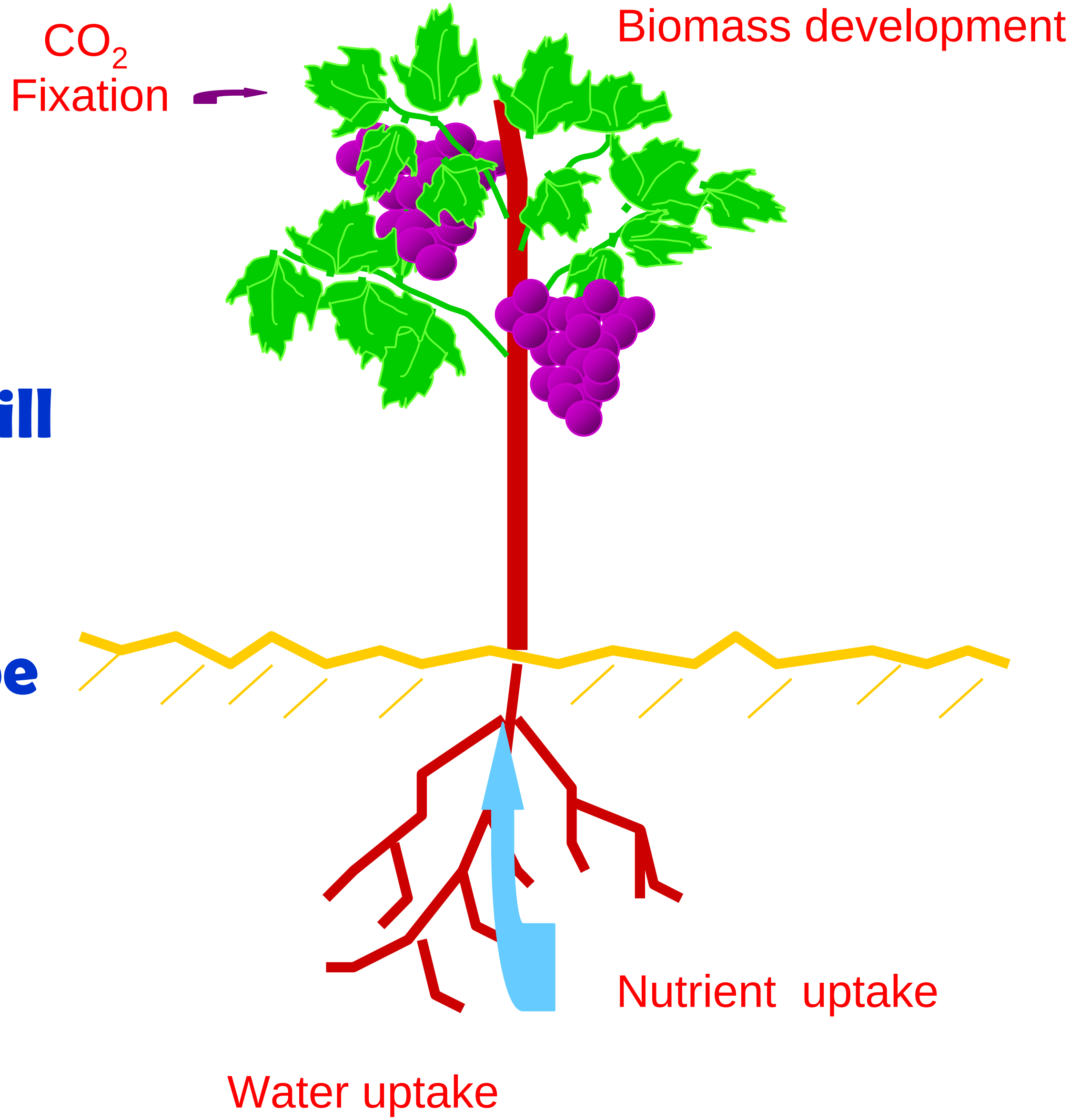
- All crops studied are highly efficient in CO_2 fixation

- Better crop conditions will optimise the CO_2 efficient

- The byproducts should be taken into account



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Proteín identification


CO_2 exchange

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Group of Aquaporins

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Celia Gutierrez-PhD student
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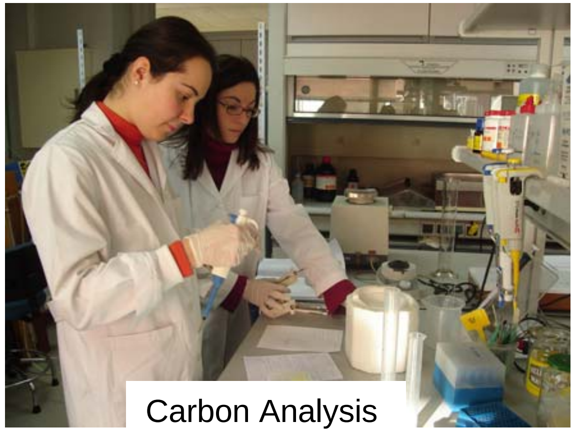
Estomata analysis


Carbon Analysis