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Changes in the nutritional value of rice grown under two projected climate change scenarios: elevated CO_2 and elevated CO_2 + elevated temperature

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Global climate change

Two main facets of climate currently undergoing man-made changes:

1. Atmospheric CO_2

2. Air temperature

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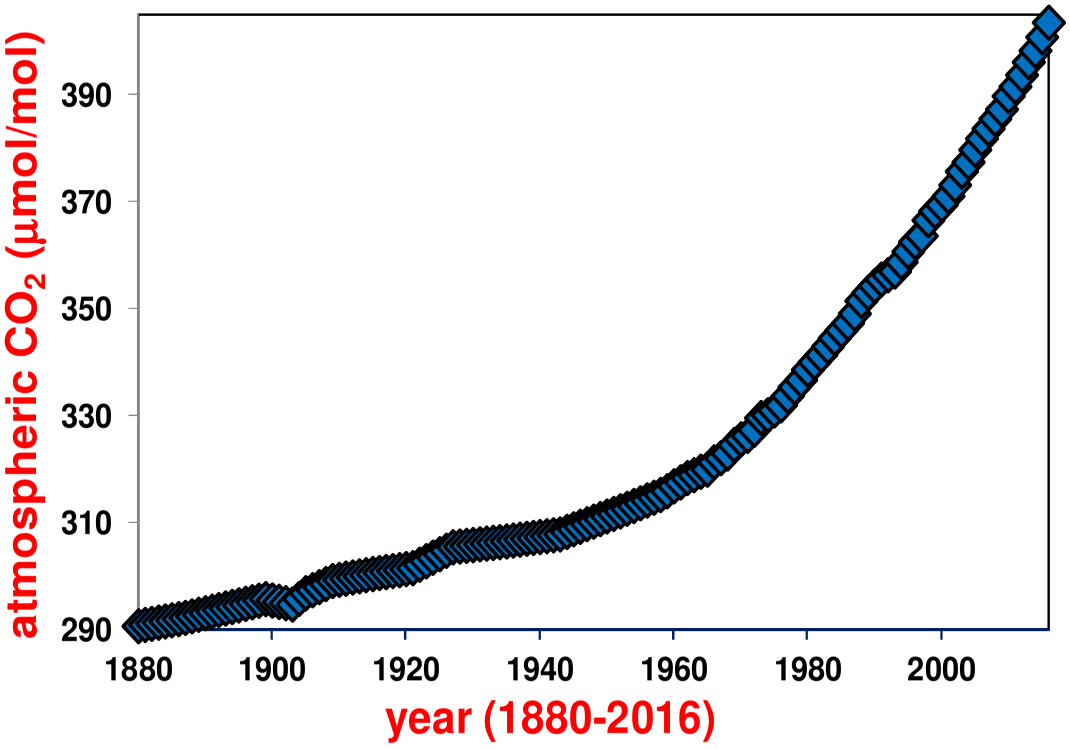
Global CO_2 levels

Increases from 290.74 in 1880 to 403.60 μmol/mol in 2016



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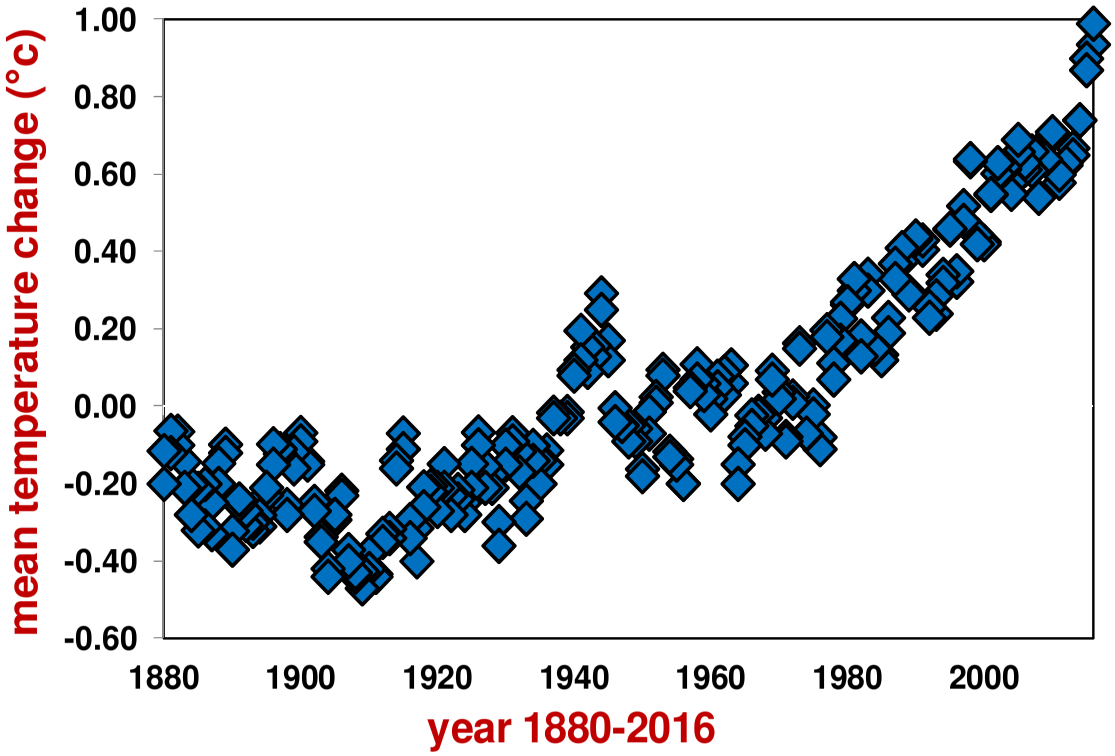
Mean temperature changes

Change from -0.20 in 1880 to 0.94 °C in 2016 compared to pre-industrial levels



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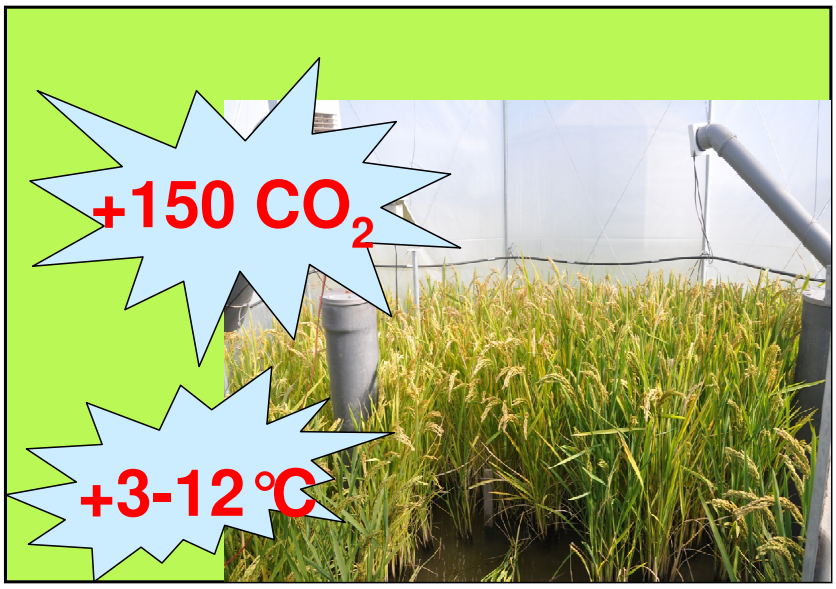
Projected climate changes by 2050



It is anticipated that global CO_2 will increase and reach 550 µmol/mol by the mid of the 21st century

This could be accompanied by a 3–12 ℃ increase in temperature, depending on the regions

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Objectives of the report

Assess the effect of these projected changes in climate on rice quality

Recommend on how to maintain or enhance the nutritional value of rice

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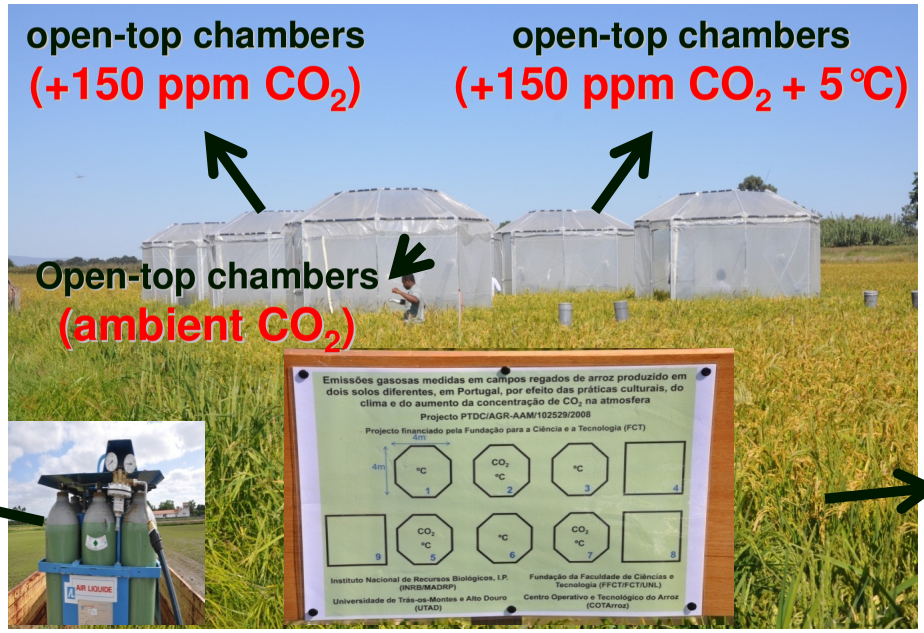
Open-top chambers design

elevation of CO_2 (+150 ppm)

elevation of CO_2 (+150 ppm) and temperature (+ 5 ℃)

COTArroz - Salvaterra de Magos



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Harvesting and milling of "Ariete"

rough rice

Rice husk

Brown rice

Rice bran

White rice

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Nutritional parameters evaluated

1. **Nutrients:** amino acids, fatty acids, dietary fibers, free sugars, minerals

2. **Antinutrients:** phytic acid

3. **Antioxidants:** vitamins, phenolic acids, flavonoids

4. **Sensory attributes:** cooking, eating, appearance

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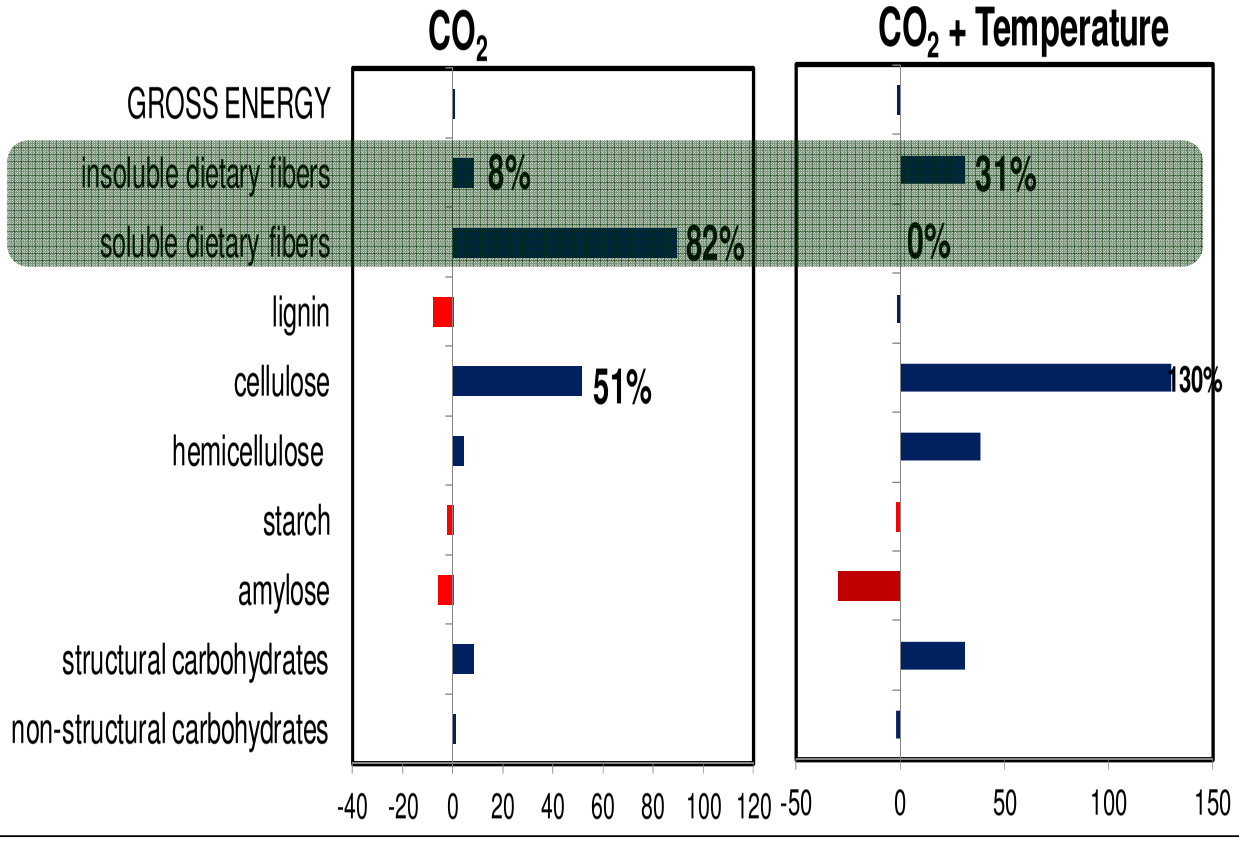
Climate change on DIETARY FIBERS



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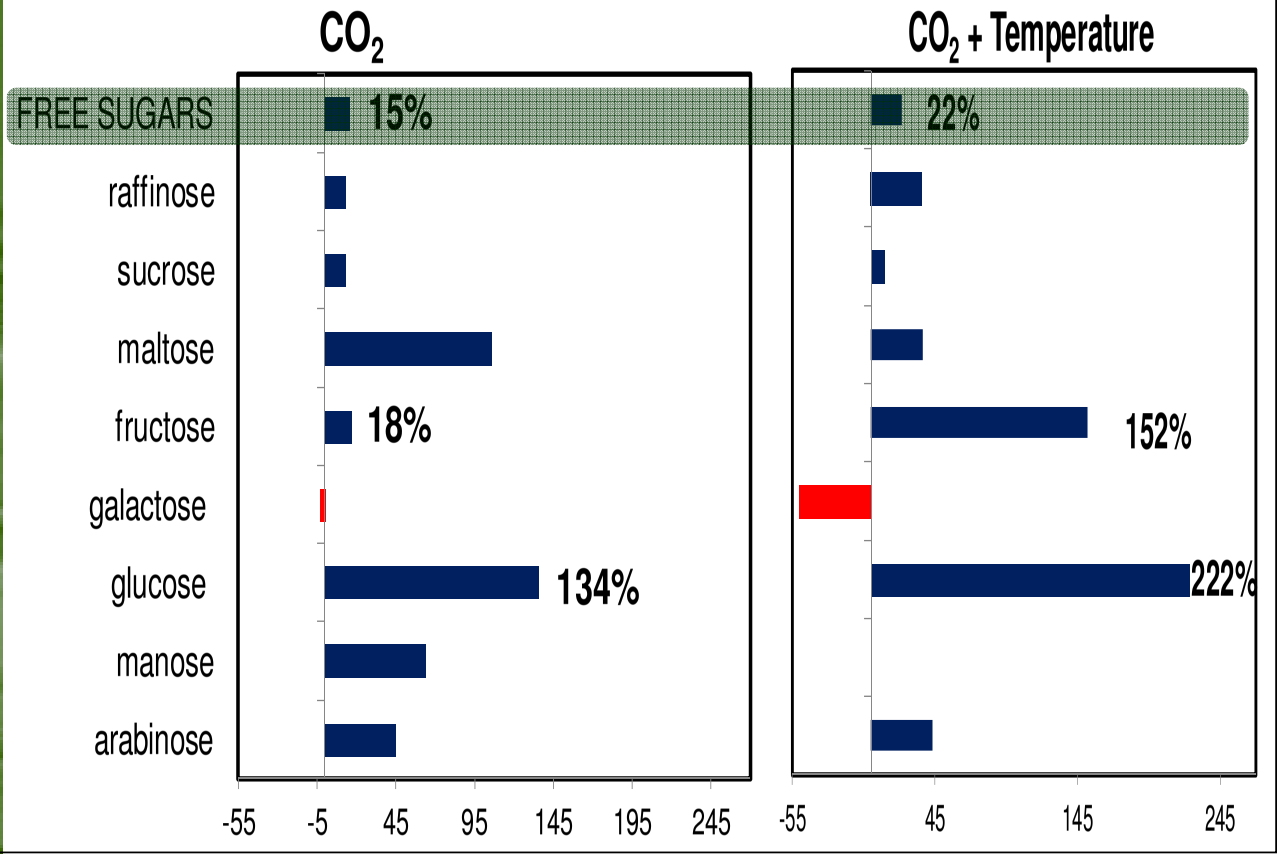
Climate change on FREE SUGARS



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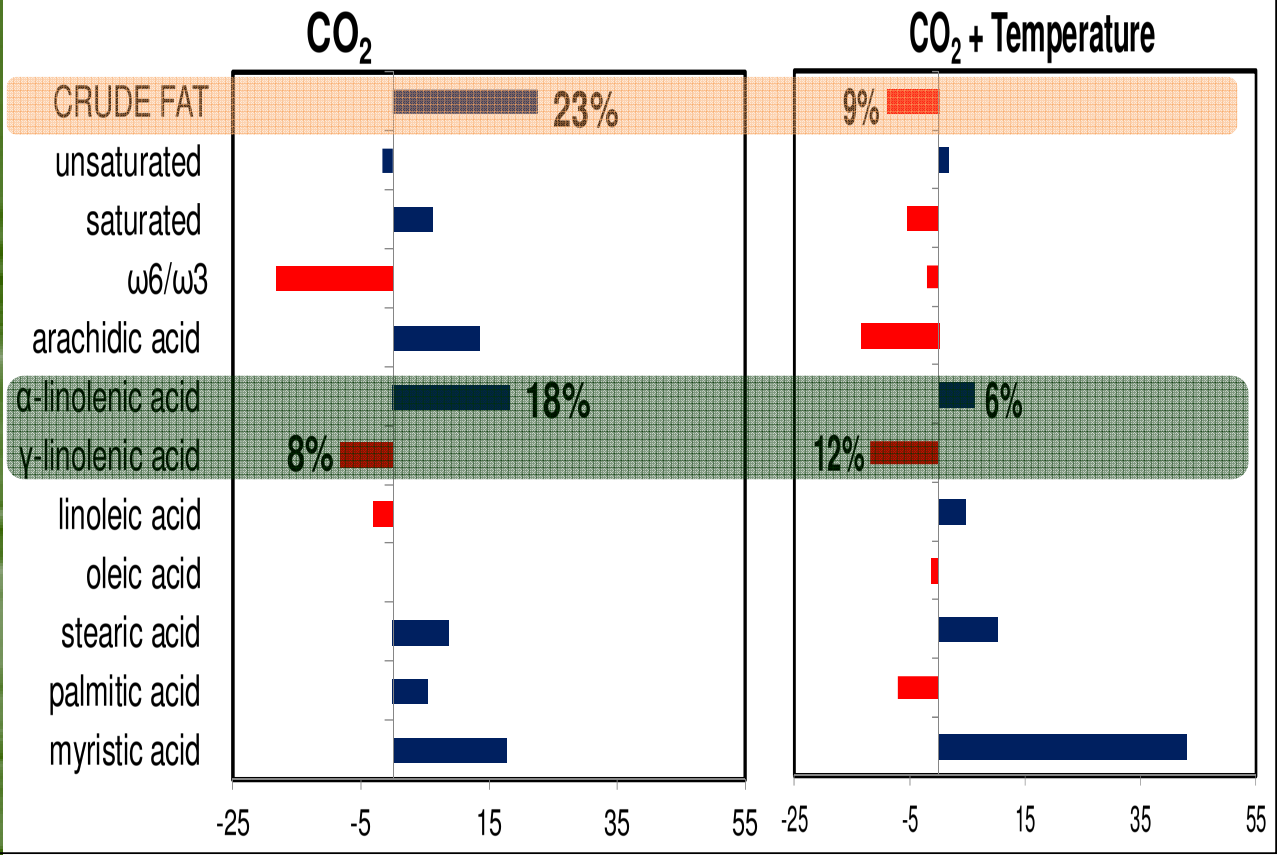
Climate change on FATTY ACIDS



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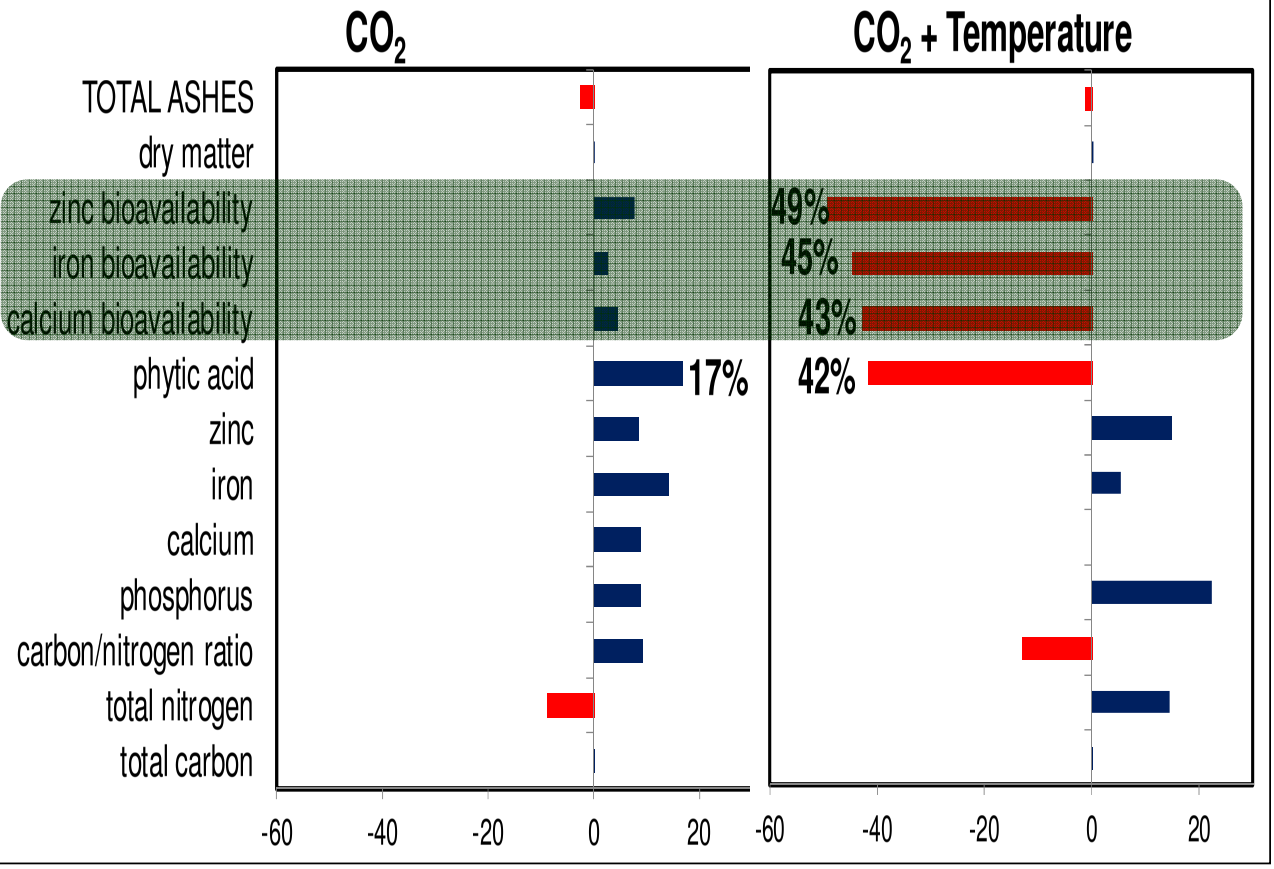
Climate change on MINERALS



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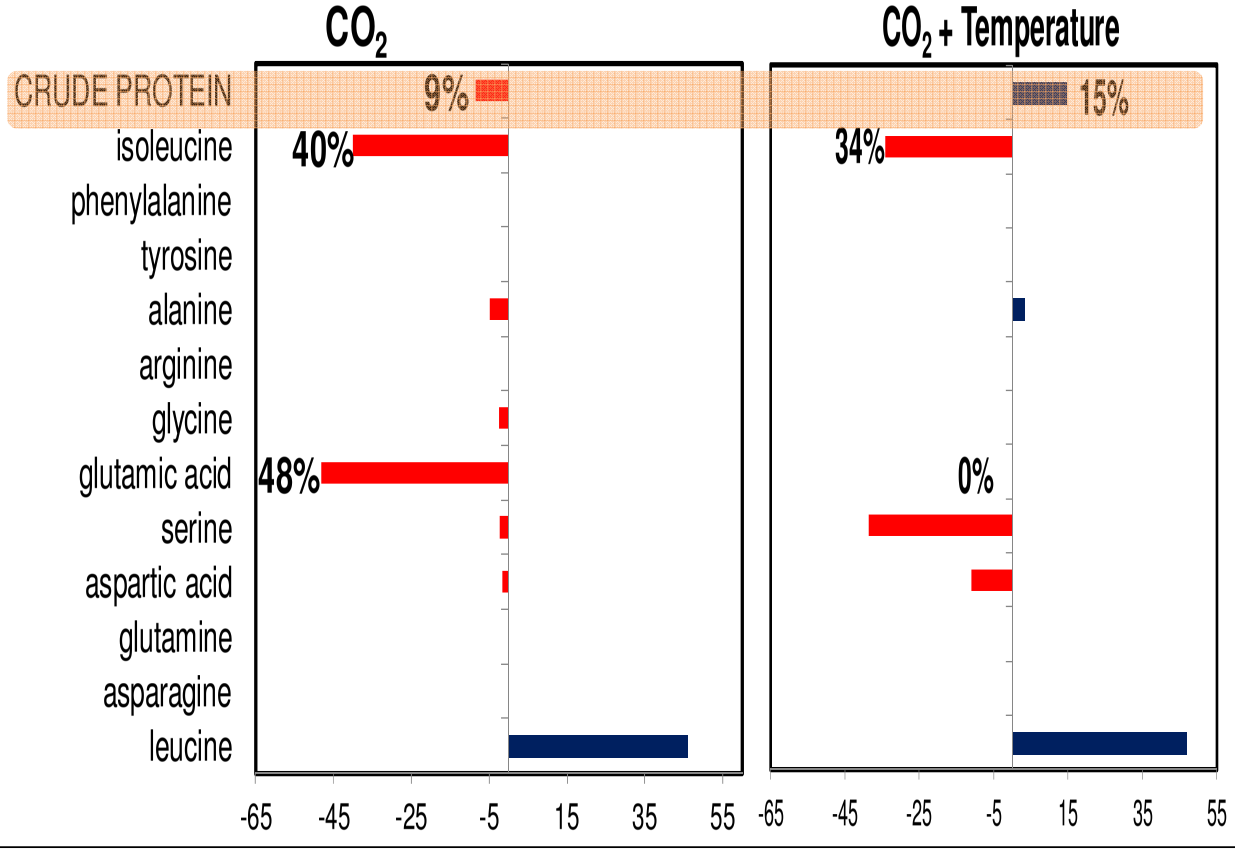
Climate change on AMINO ACIDS



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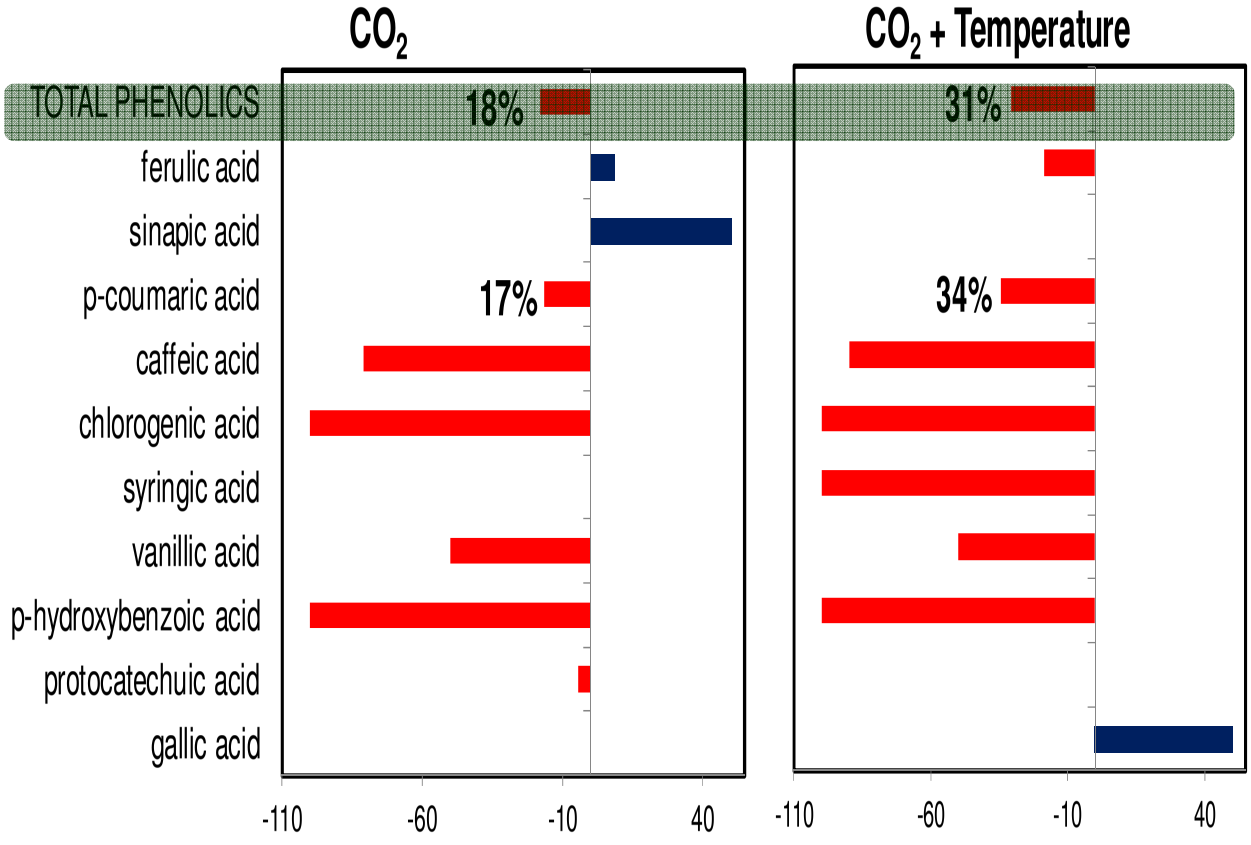
Climate change on PHENOLIC ACIDS



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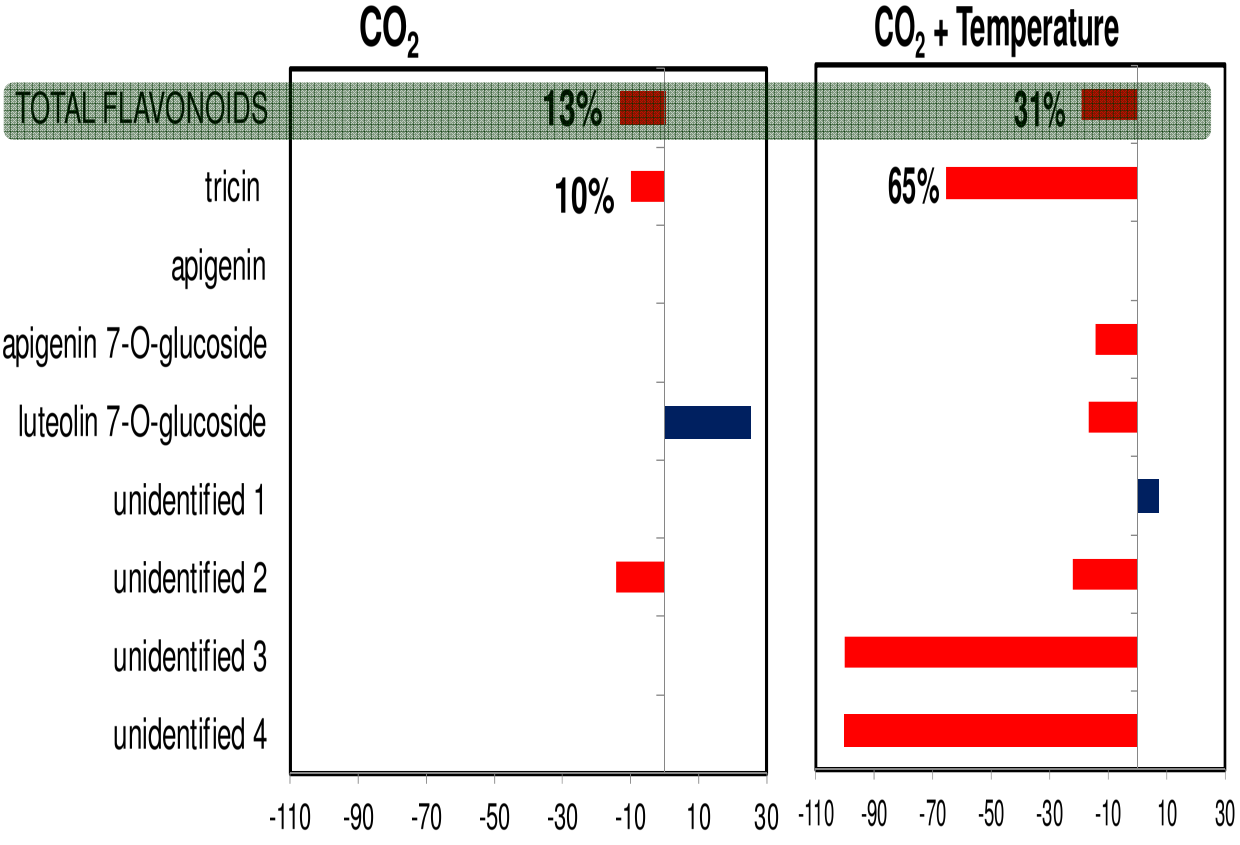
Climate change on FLAVONOIDS



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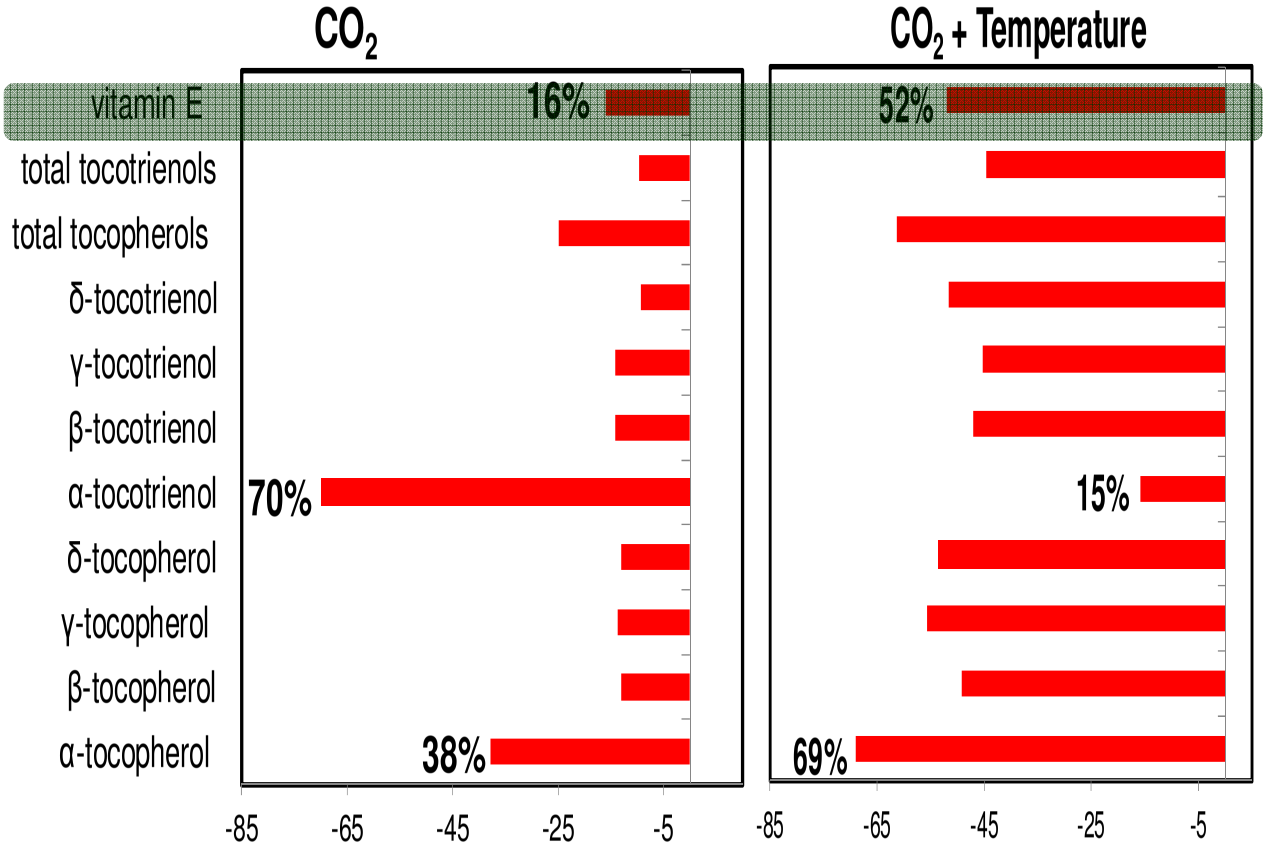
Climate change on VITAMIN E



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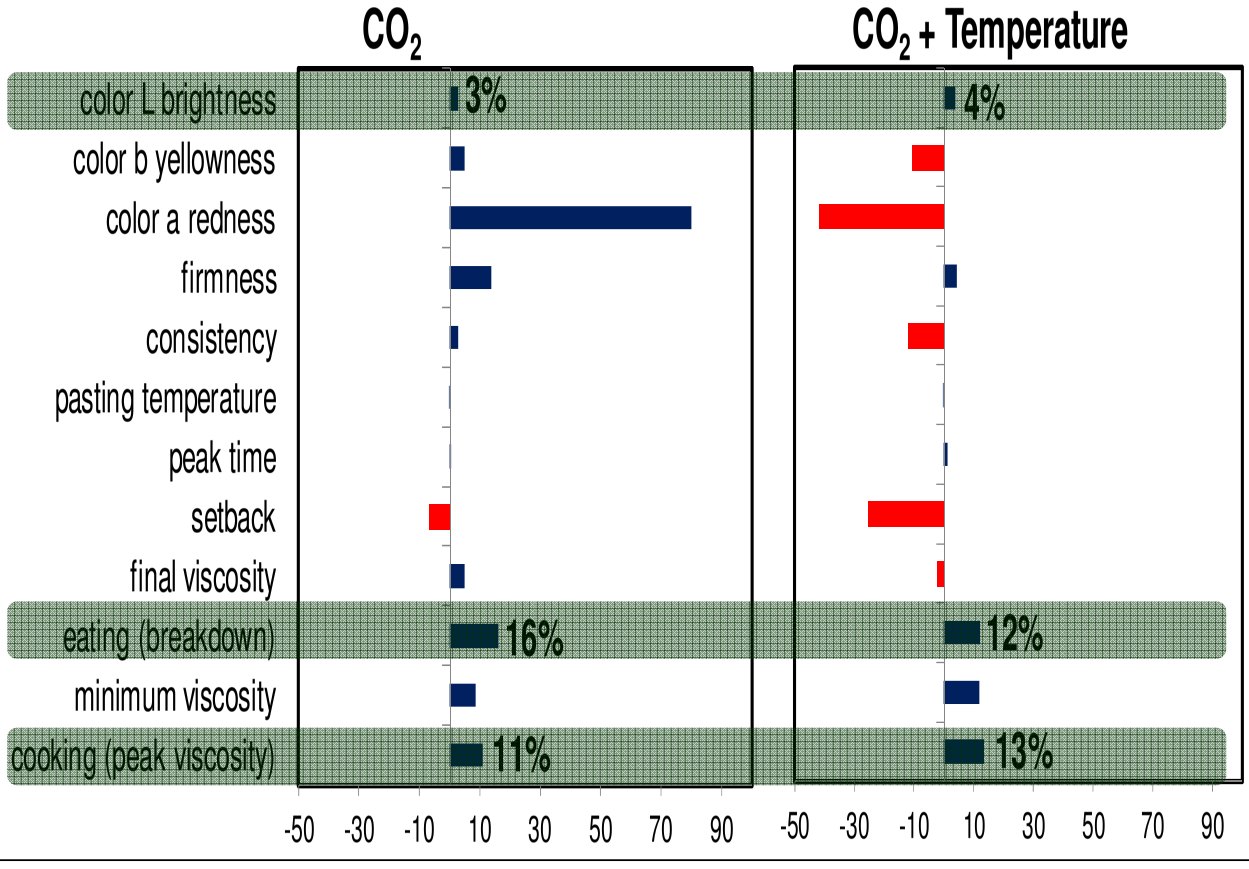
Climate change on SENSORY TRAITS



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Beneficial effects of climate change

dietary fibers

free sugars

elevated CO_2

positive effects

elevated CO_2 + temperature

more positive effects

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Negative effects of climate change

phenolics

vitamin E

elevated CO_2

negative effects

elevated CO_2 + temperature

more negative effects

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Negative effects of climate change

protein and amino acids

↓

elevated CO_2

negative effects

elevated CO_2 + temperature

less negative effects

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Contrasting effects of climate change

mineral bioavailability

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elevated CO_2

positive effects

elevated CO_2 + temperature

negative effects

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Recommendations for Portugal rices

1. **Maintain "Ariete" as a leading cultivar:** If the main end-use of rice is richness in dietary fibers and digestibility

2. **Selection or breeding for new varieties:** If cultivar rich in both dietary fibers and antioxidants compounds are needed

3. **Adopting new growing and processing practices:** In taking into consideration data on rice management practices glathered from the study

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Acknowledgements

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