CAPITALISE

www.capitalise.eu

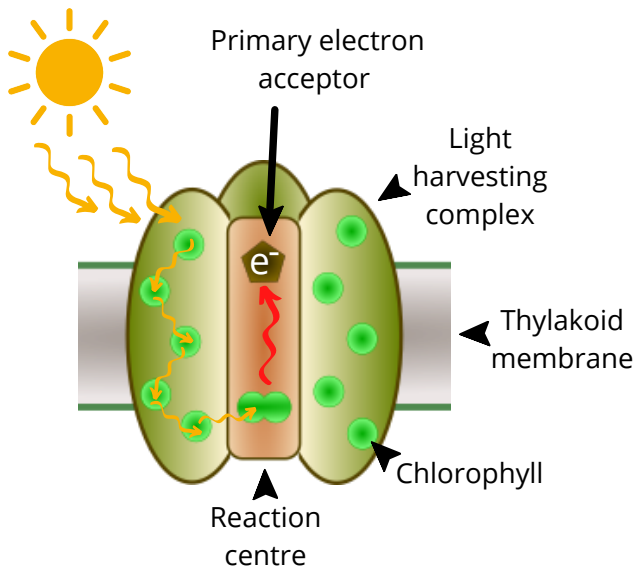
BREEDING FOR BETTER PHOTOSYNTHESIS

3. TUNING LEAF CHLOROPHYLL CONTENT

Reducing leaf chlorophyll content of the crop can save nitrogen, allow a denser planting and improve light penetration and interception through the canopy

LIGHT HARVESTING

During photosynthesis, energy from the sun is captured by chlorophyll molecules in the light harvesting apparatus present on the thylakoid membrane of chloroplasts and fed to the photosynthetic reaction centres that drive electron transport.



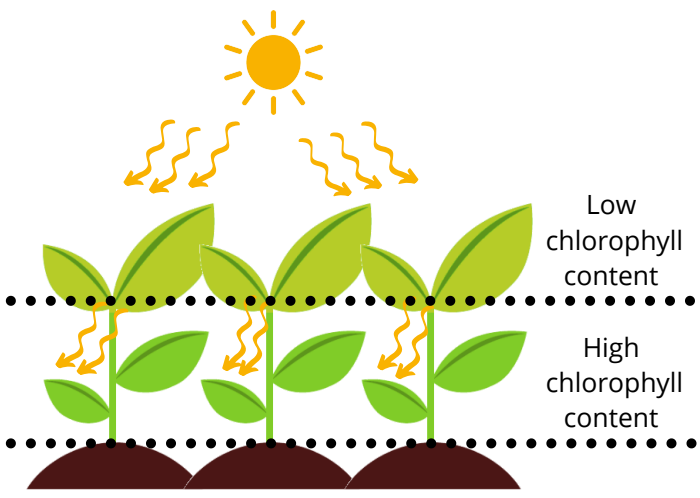
LIMITATIONS

During evolution and domestication, light harvesting apparatus has shown the tendency to be optimized for low light and over-invests in the photosystems and chlorophyll.

Modelling work indicates that the light harvesting antennae are too large, in particular at the top of the canopy, and trap more light energy than they can use. These antennae are the chlorophyll molecules that harvest light energy.

SOLUTION

Several studies have now shown proof-of-concept that some mutant plants with decreased chlorophyll content were more productive in the field delivering increased yields.



Ideal crops would contain less chlorophyll at the top of the canopy that would allow more light to reach lower leaves (based on Ort et al. 2015 [1].

Screening a range of mutant plants with different chlorophyll levels and distribution can identify smarter canopy candidates. Such germplasms already exist for a range of crops such as barley, tomato and maize.

Barley, tomato and maize low chlorophyll germplasms. (a.) Barley chlorina-f2 mutant line - chlorophyll b is absent [2]; (b.) The tomato-MUT collection contains over 500 accessions showing a diversity in leaf pigmentation [3]; (c.) The Maize Mu-insertion database [4].

Crop plants with optimized chlorophyll levels will provide **new tools** with which to **increase the rate of CO_2 fixation**. This has the added potential to **save nitrogen, increase plant biomass and improve light use efficiency**.

References: [1] DOI: 10.1073/pnas.1424031112; **[2]** https://www.walz.com/downloads/pan/PAN07005.pdf; **[3]** DOI: 10.1111/j.1365-313X.2004.02088.x, BASF **[4]** http://pml.uoregon.edu/photosyntheticml.html.

THE CAPITALISE PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 862201