

EFFECTS OF A FREE AMINO ACID-RICH BIOSTIMULANT LEAFAMINE® BIOSTIMULANT ALLEVIATES HEAT-STRESS EFFECTS IN TOMATO



Loé Malgouyre^{1,2}, Renaud Sergheraert², Nathalie Gonzalez¹, Emmanuelle Mounier², Michel Hernould¹ and Frédéric Delmas¹
¹ Université de Bordeaux, INRAE, UMR1332 Biologie du Fruit et Pathologie, F-33882 Villenave d'Ornon, France
² BCF Life Sciences, Boisel, 56140 Pleucadeuc, France

lmalgouyre@bcf-lifesciences.com
 +33 (0)6 74 00 24 51

Heat waves cause significant yield losses on many crops and will become more frequent with climate change. However, it is essential to maintain sufficient agro-food production to deal with an increasing world population. Among the different solutions to face the effects of climate change and global warming, biostimulants look very attractive.

Biostimulants are described as products that stimulate plant natural processes and increase their nutritional efficiency and resistance to abiotic stresses³. Leafamine® is a biostimulant with a high content (82%) of free amino acids.

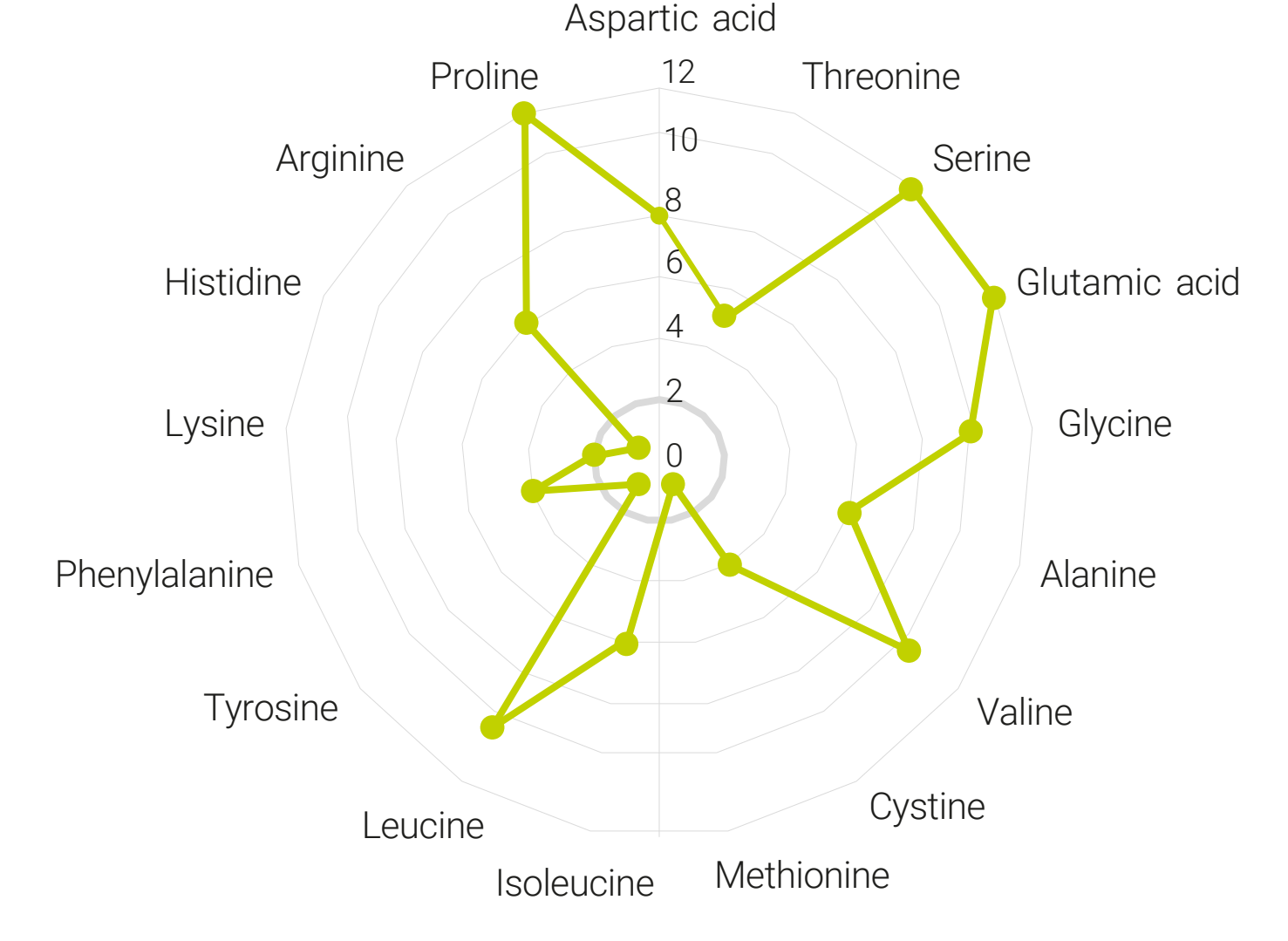
To determine if Leafamine® can provide heat-wave tolerance to tomato plants for alleviating heat-stress effects, we performed *in vitro* culture and greenhouse experiments under normal and high ambient temperatures to evaluate plant development at morphometric and molecular levels by measuring yield, marker gene expressions and metabolite contents.

Preliminary results show that Leafamine® improve root development either in normal and high ambient conditions and result in increased expressions of genes that promote root development. Interestingly, the application of Leafamine® during heat waves reduces the negative impact on fruit yield by 15% due to an increase in the production of larger fruits by 33%. In addition, Leafamine® modifies tomato leaves primary metabolism.



- Instant powder
- Usable in organic farming
- Formulation : stable, microorganism free & heavy metal free
- Food grade
- Market authorizations (AMM) in France in progress « additive agronomic & finished product »

A UNIQUE AMINO ACIDS PROFILE

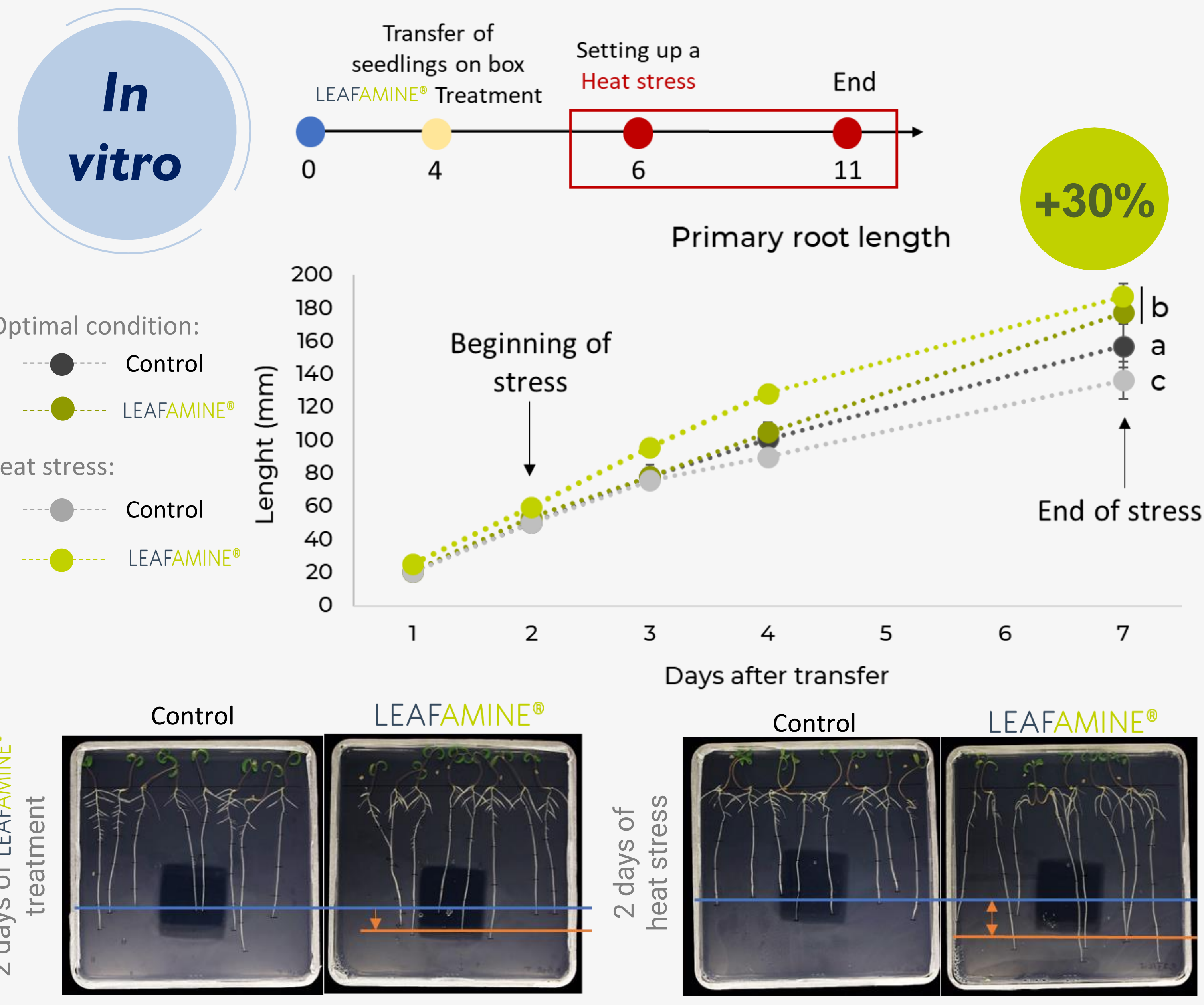


Relative content of free AA in % of total free AA

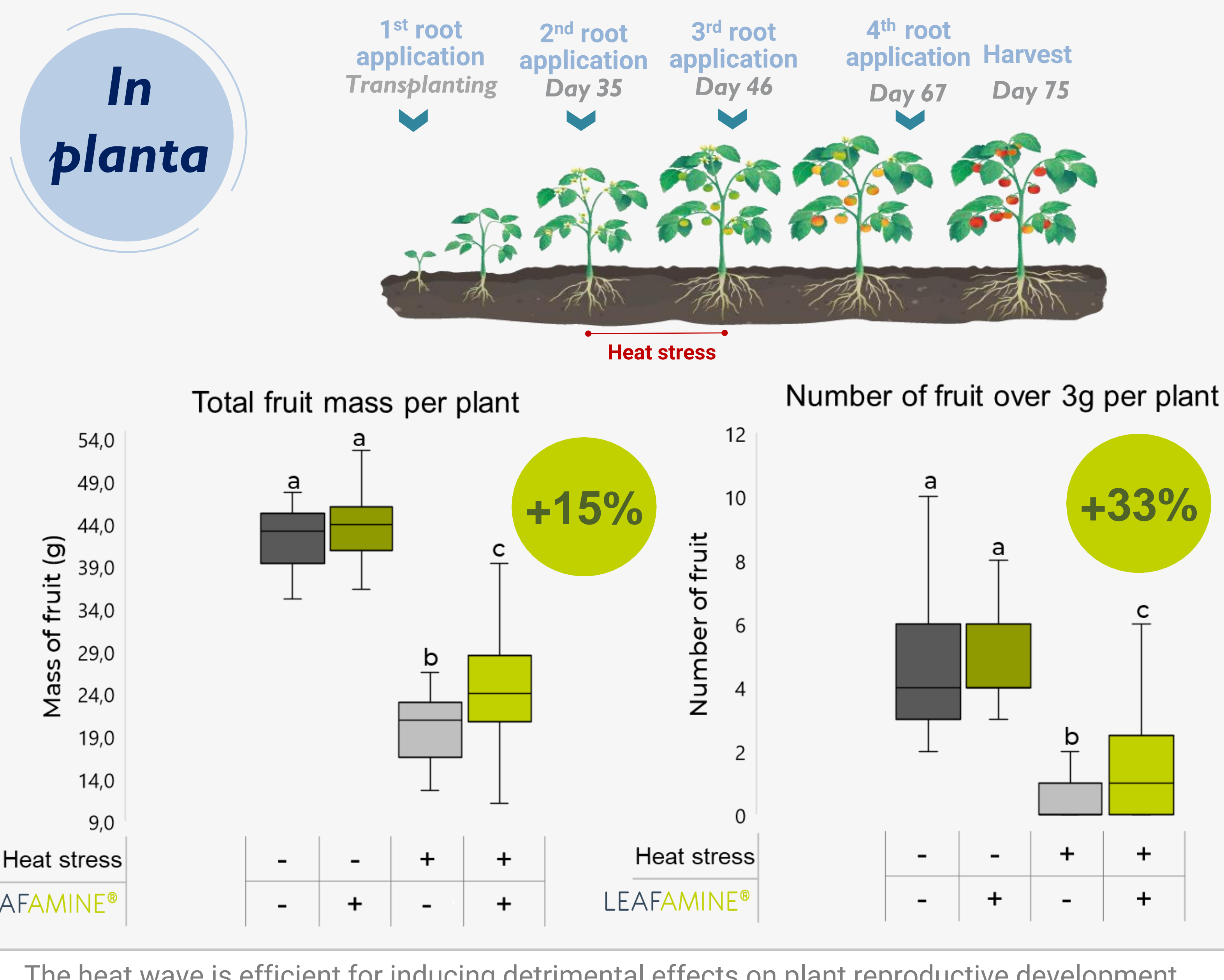
- Free L-Amino acids (82%)
- Low molecular weight (92,2 % of AA < 240 Da and 100% < 800 Da)

MATERIAL & METHOD

- LEAFAMINE® : 0.15g/L
- Heat stress condition : 32°C day – 25°C night
- Normal condition : 26°C day – 18°C night
- Varieties: In vitro assays (M82) & In planta trials (Microtom)

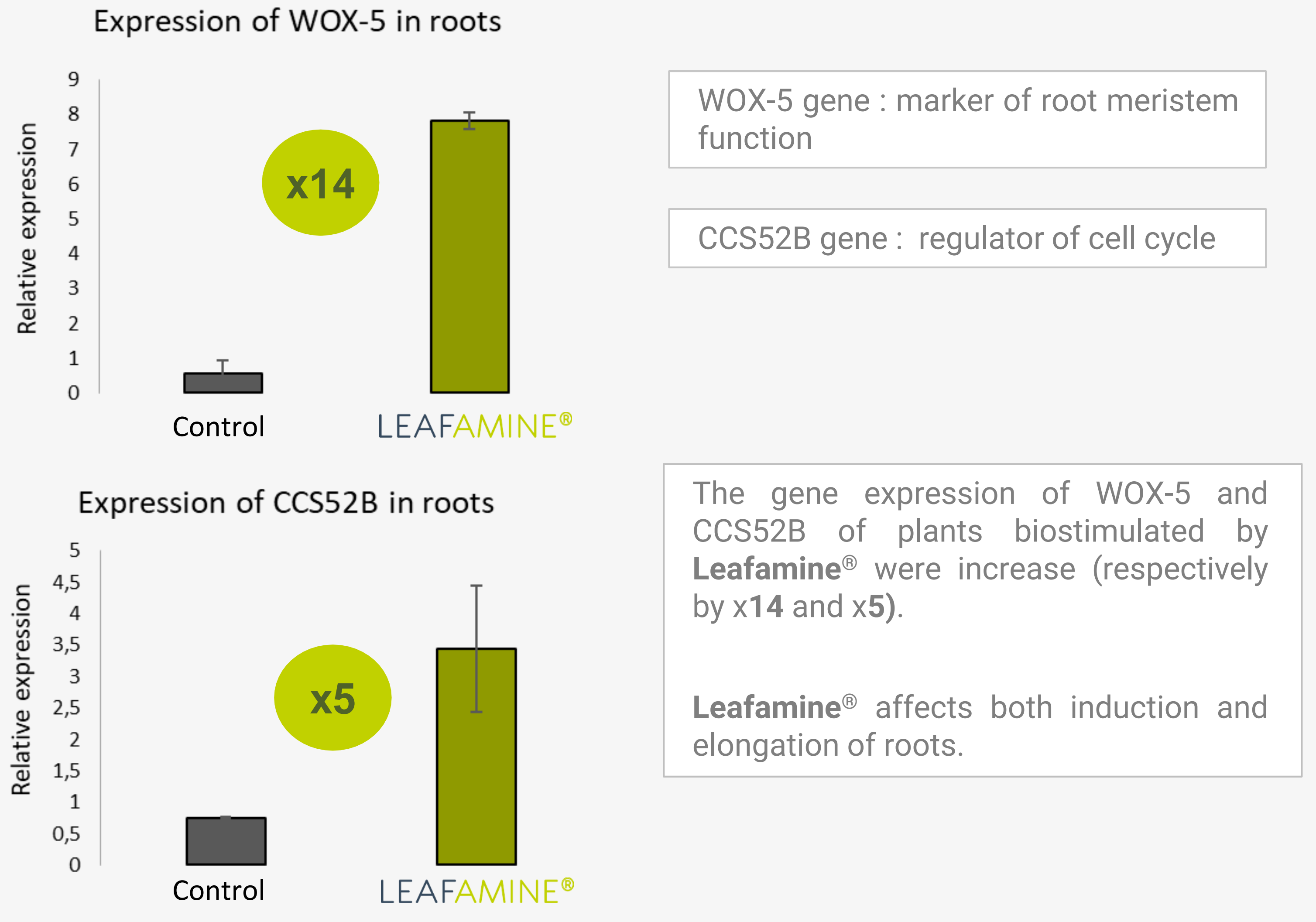


Heat stress affected the primary root growth of untreated plant. Leafamine® positively increases the development of the primary root of tomato plantlets in normal or in heat-stress conditions by respectively 13% and 30%.



The heat wave is efficient for inducing detrimental effects on plant reproductive development. Leafamine® treatment can decrease the effects of the heat-stress on the fruit yield (+15%). The heat stress-alleviating effects of Leafamine® on fruit yield is mainly due to the maintenance of the production of large fruits than to the maintenance of total fruit number.

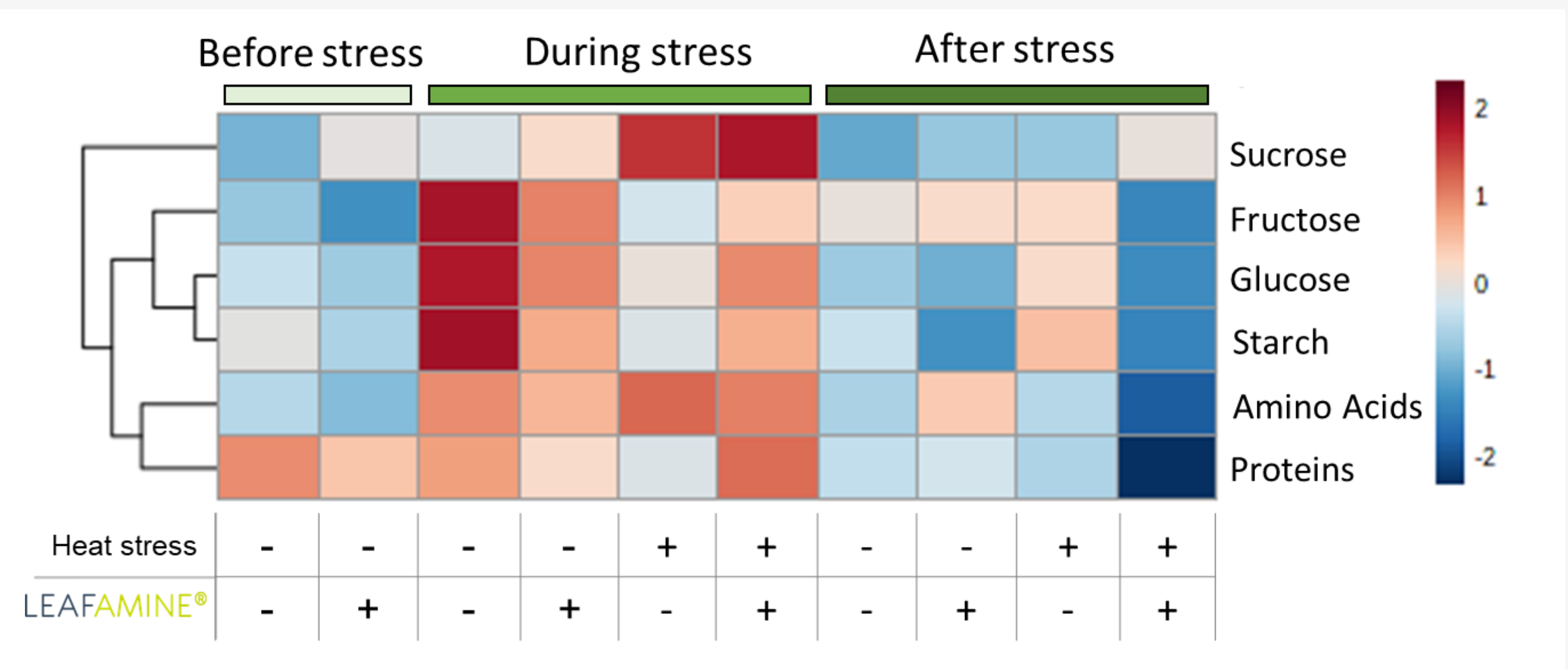
Molecular analysis – On optimal comfort condition



WOX-5 gene : marker of root meristem function
 CCS52B gene : regulator of cell cycle

The gene expression of WOX-5 and CCS52B of plants biostimulated by Leafamine® were increase (respectively by x14 and x5).
 Leafamine® affects both induction and elongation of roots.

Metabolism analysis of tomato leaves



Leafamine® increases glucose, fructose and starch content in heat-stress condition and decreases it content after the heat-stress.
 Leafamine® allows an increase of sucrose accumulation in heat-stress conditions and the difference of sucrose accumulation is maintained after the heat-stress.
 Leafamine® affects the plant metabolism but mainly in plants that were submitted to heat-stress.

Leafamine® improves significantly root development in comfort and heat-stress condition.
Leafamine® decreases the loss of yield causes by heat-stress condition.
Leafamine® affects metabolism of tomato leaves. What about fruit?

References:
³Du Jardin, P., 2015. Plant biostimulants: Definition, concept, main categories and regulation. Scientia Horticulturae, Biostimulants in Horticulture.
 Colla, G., et al., 2017. Biostimulant Action of Protein Hydrolysates: Unraveling Their Effects on Plant Physiology and Microbiome. Frontiers in Plant Science.
 Malécange, M.; Pérez-García, M.-D.; Citerne, S.; Sergheraert, R.; Lalande, J.; Teulat, B.; Mounier, E.; Sakr, S.; Lothier, J. Leafamine®, a Free Amino Acid-Rich Biostimulant, Promotes Growth Performance of Deficit-Irrigated Lettuce. Int. J. Mol. Sci. 2022, 23, 7338.