



Plant-based bioproduction platforms

Why development should be encouraged and how

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Scientific strategies from recent outbreaks to help us prepare for Pathogen X
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State of the art in plant bioproduction platforms

- *Nicotiana benthamiana* transient expression system is used as standard.
- Successful up to Phase III (e.g., Medicago SARS CoV2 and influenza) established.
- Intense academic research in (i) chassis/platform improvement and (ii) product development.
- Expanding Industrial landscape with several medium-size production companies worldwide



Advantages of plant bioproduction (for pathogen X)

Sustainability: lower input requirements

Modularity: one plant, one bioreactor

Scalability: agricultural production scale

Opportunities for manufacturing repurposing

Potentially lower investment requirements



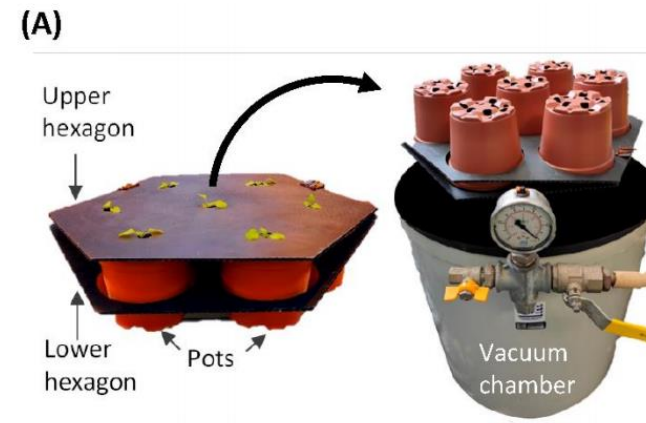
Pilot Production of SARS-CoV-2 Related Proteins in Plants: A Proof of Concept for Rapid Repurposing of Indoor Farms Into Biomanufacturing Facilities

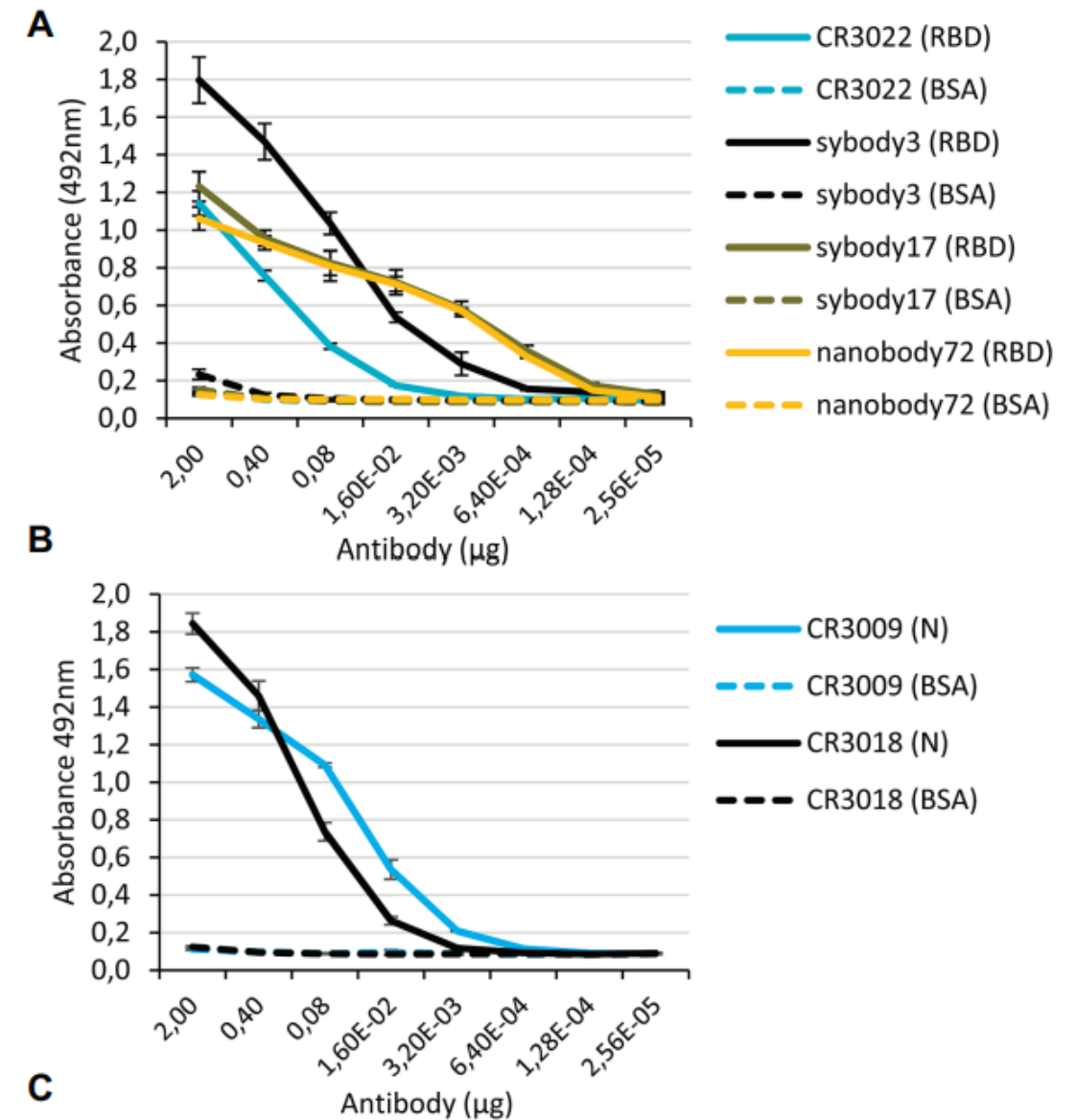
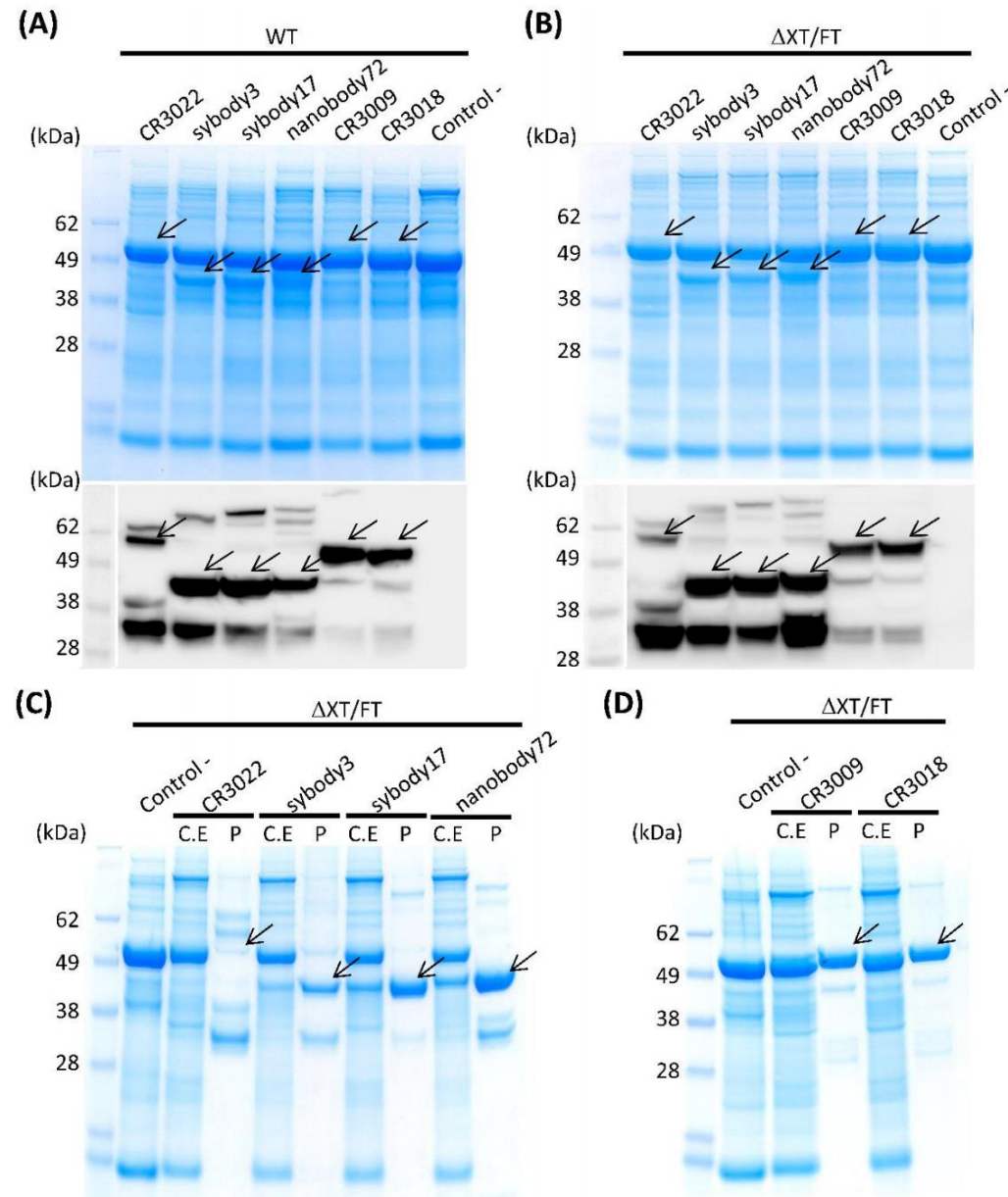
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Purified protein	Yield (µg/g FW)
CR3022	73.06
sybody3	122.53
sybody17	153.36
nanobody72	192.63
CR3009	73.38
CR3018	81.24
nRBD:His (Buffer A)	4.31
nRBD:His (Buffer B)	4.02
bRBD:His (Buffer A)	2.94
bRBD:His (Buffer B)	5.21
His:bN (Buffer A)	30.98





Repurposing pilot study

TIMING (In this work)

d0 d10 d30 d50 d65

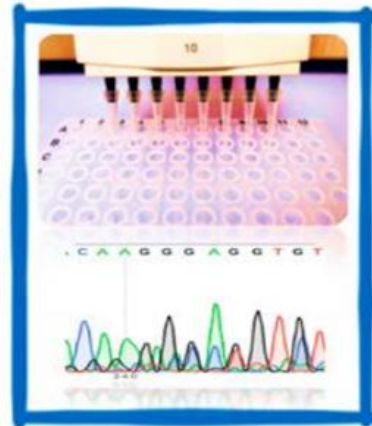
Build

- *In silico* design
- Gene synthesis

Design



- DNA assembly
- Sanger sequencing



- Agroinfiltration
- Coomassie/ELISA

Test



- Upscale
- Extraction/testing

Produce



TIMING (optimized)

d0 d10 d20 d30 d45

What is needed

- R&D in platform development with focus in repurposing

The plant: breeding, genomics, phenomics, and Synbio

The product: new examples of commercial plant-made
biopharmaceuticals (Molecular farming)

The greenhouse: development of pilot double-use facilities,
vertical farming

- Do not jeopardize most advanced successful examples!
Medicago case



Future requirements

Delivering new and innovative high value products using plant molecular farming.

14 partners, 7 countries, 5 SMEs,
3 public research institutions and
6 universities



Accelerated breeding of Nicotiana species as biofactories
Using SynBio and New Plant Breeding Techniques
(**Newcotiana designer strains**)

www.newcotiana.org



**5th ISPMF Conference
Rome 2022**

<https://www.ispmf.org/>

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COVIFENZ®

COVID-19 Vaccine (plant-based virus-like particles [VLP], recombinant, adjuvanted)



Thanks for your attention

