

PHENOGRID

13 Avril, Paris

David Rousseau Univ. Angers



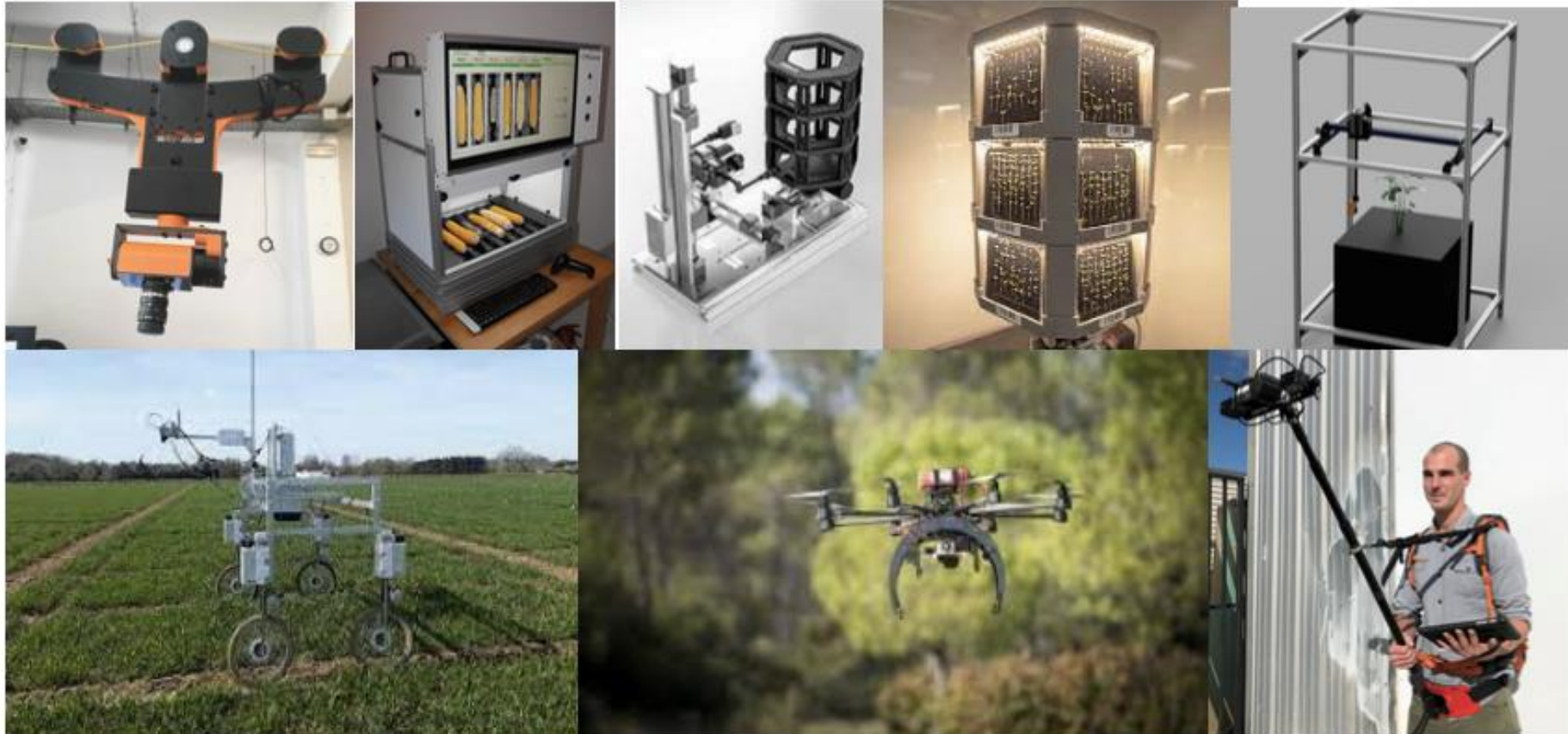
anr[®]
agence nationale
de la recherche
AU SERVICE DE LA SCIENCE

ANR11-INBS-0012

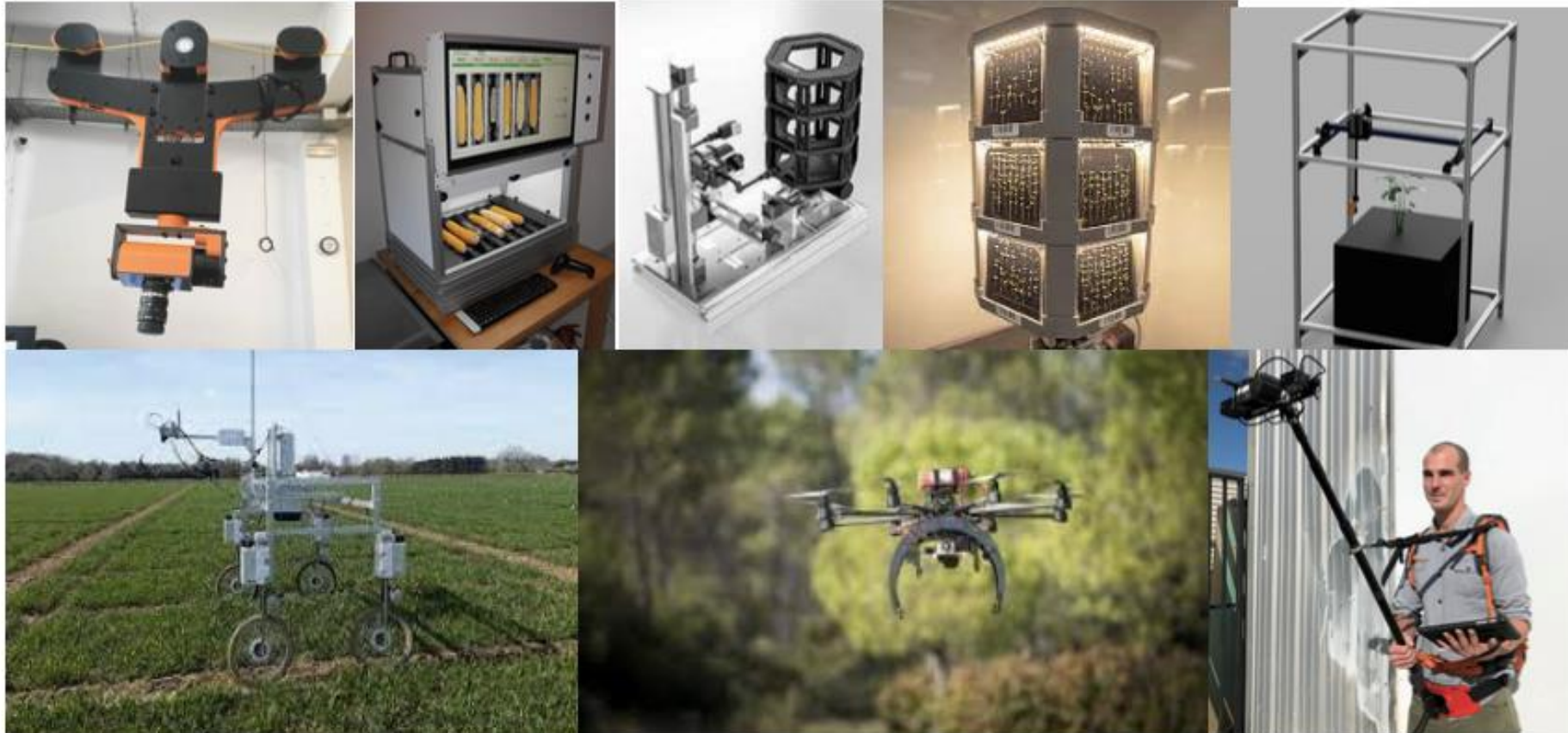
INRAE **ARVALIS**

**Terres
Inovia**
l'agronomie en mouvement

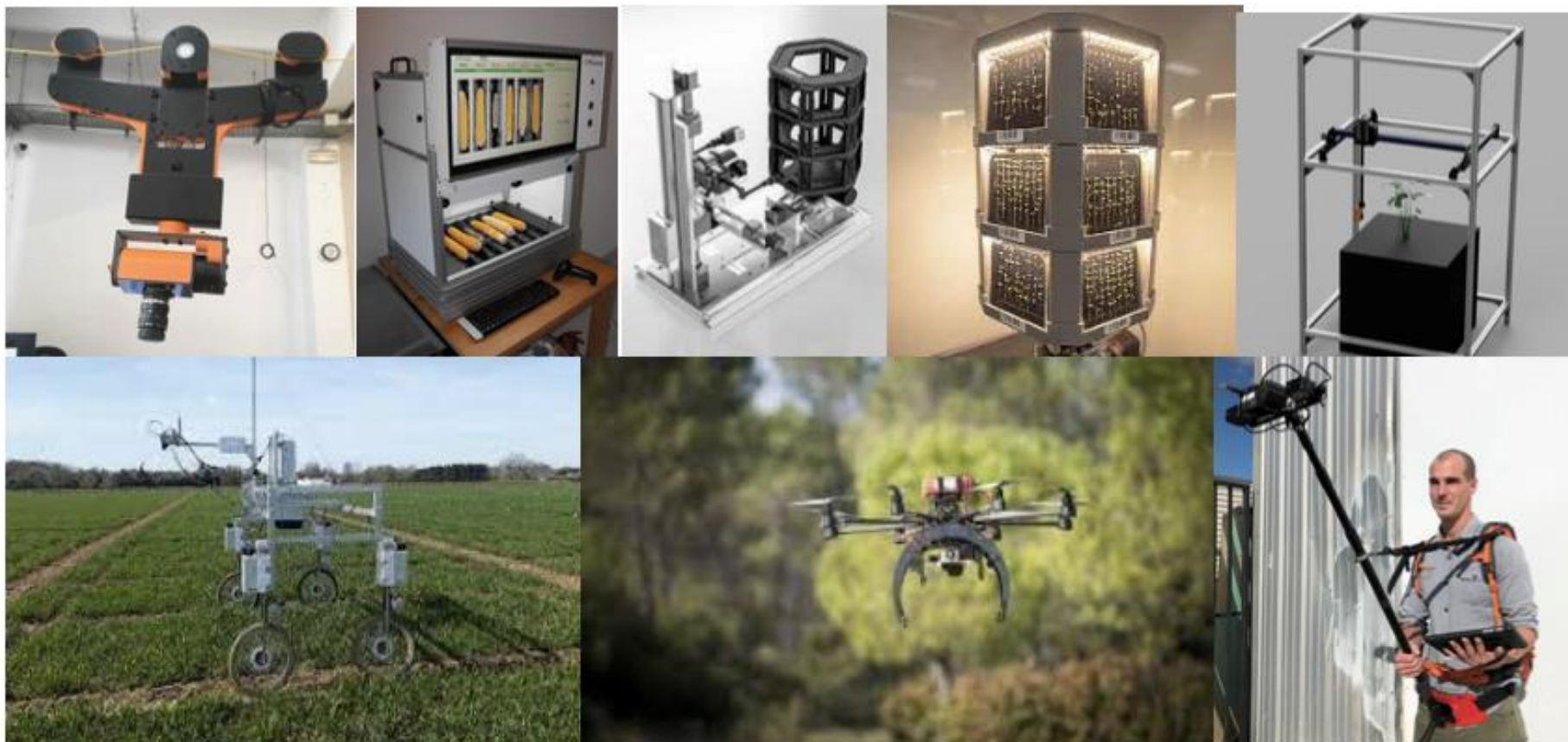
- Une diversité de questions ...



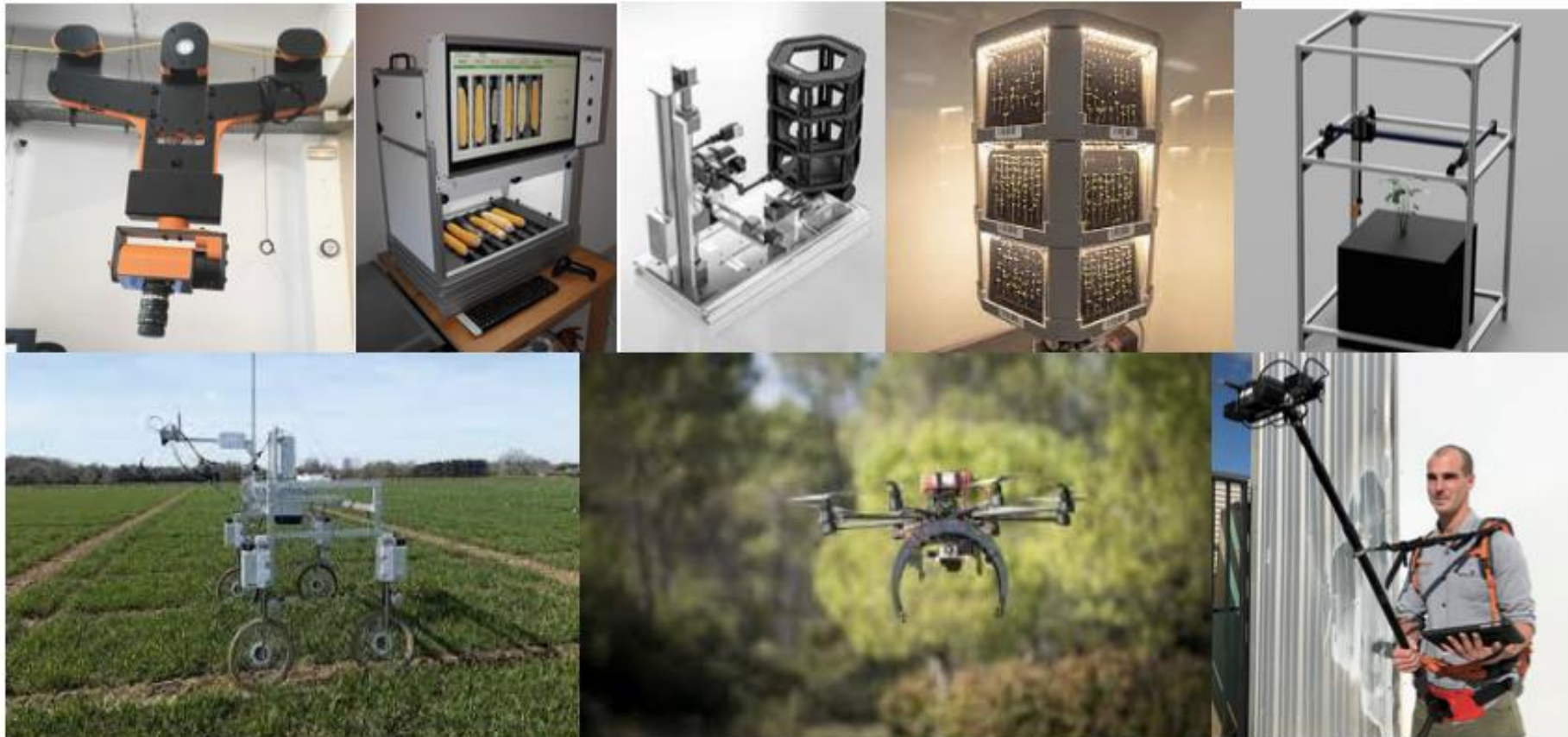
- Une diversité de questions ... besoin de prototypes à façon



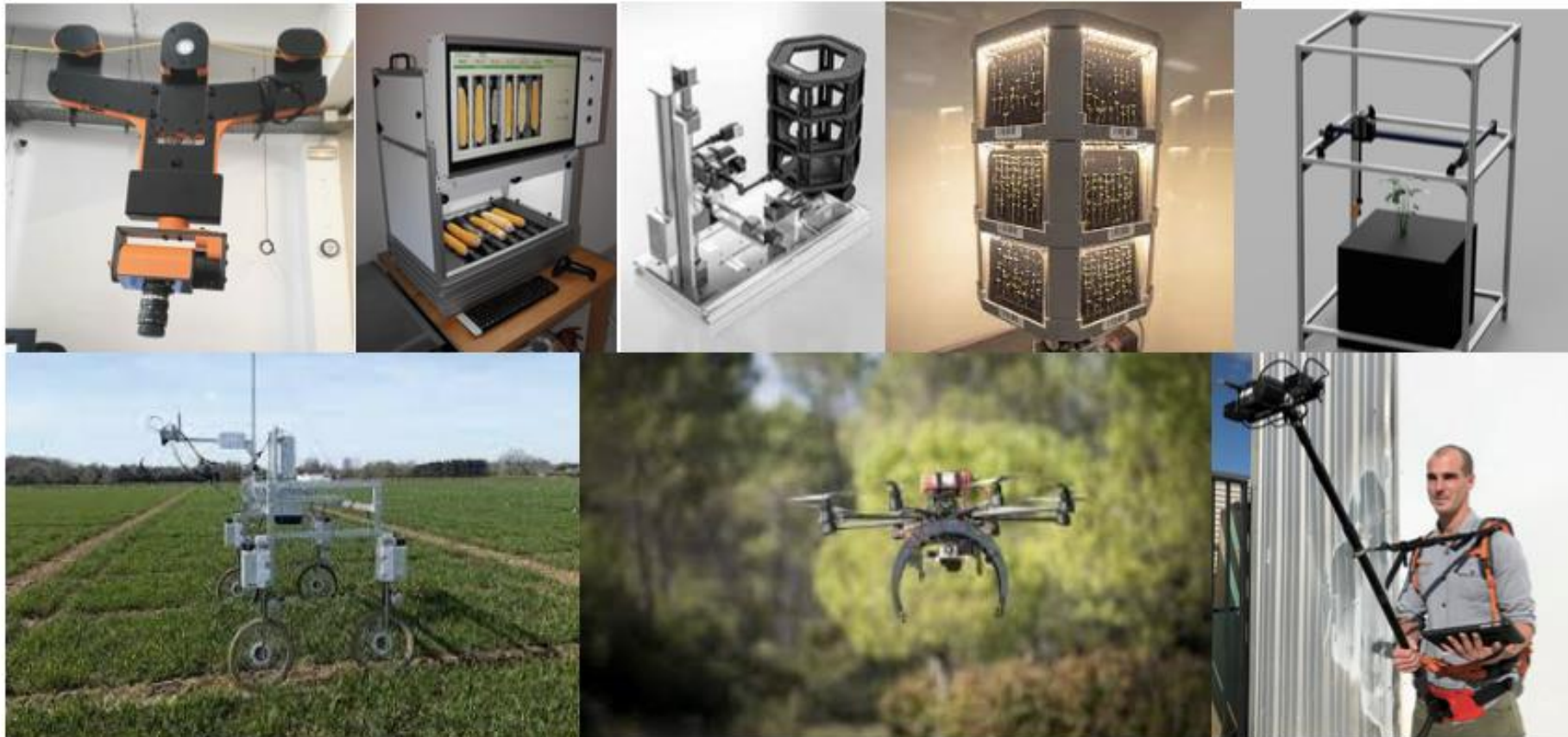
- Une diversité de questions ... besoin de prototypes à façon
- Une ambition de recherche translationnelle



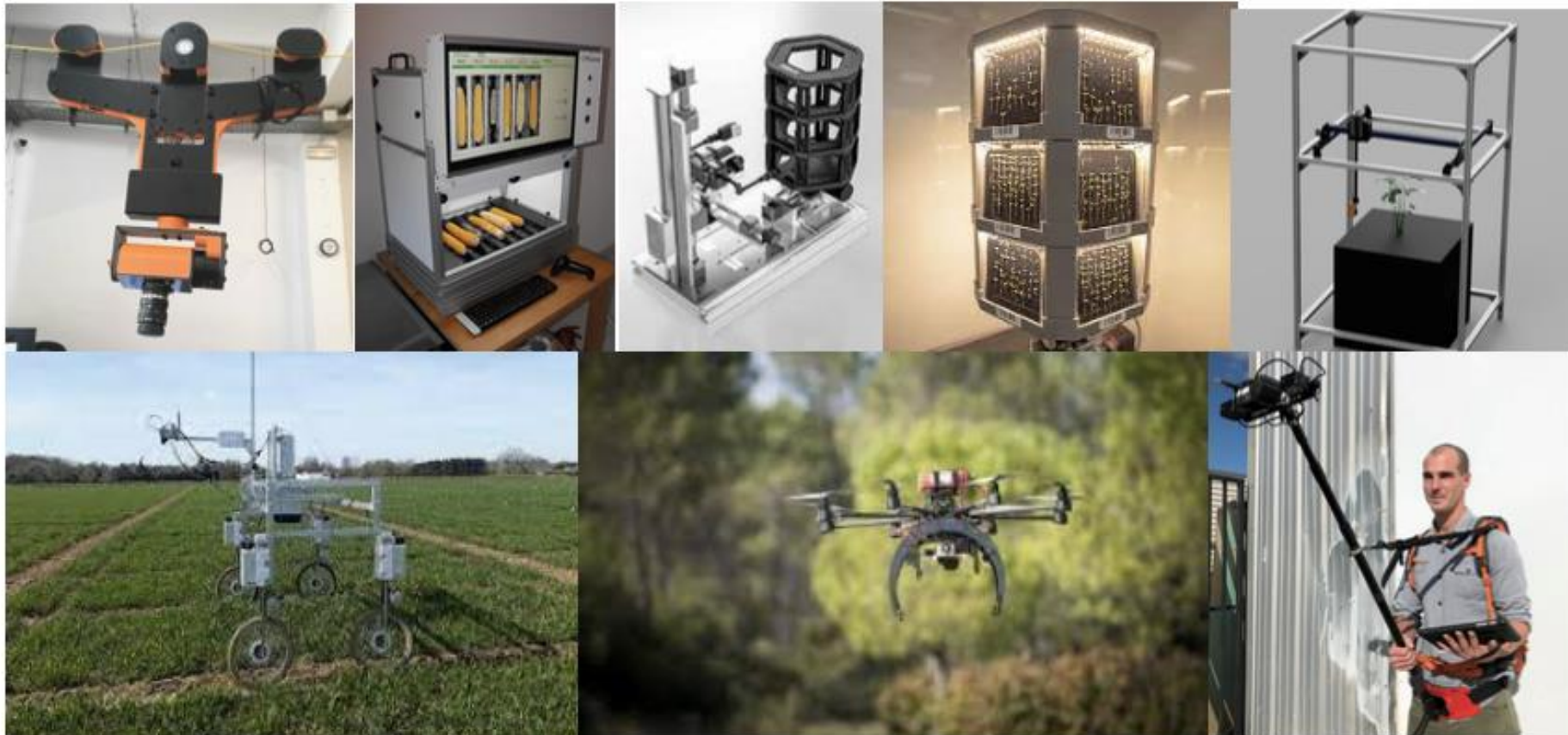
- Une diversité de questions ... besoin de prototypes à façon
- Une ambition de recherche translationnelle ... bas coût



- Une diversité de questions ... besoin de prototypes à façon
- Une ambition de recherche translationnelle ... bas coût
- Une nécessité d'accessibilité



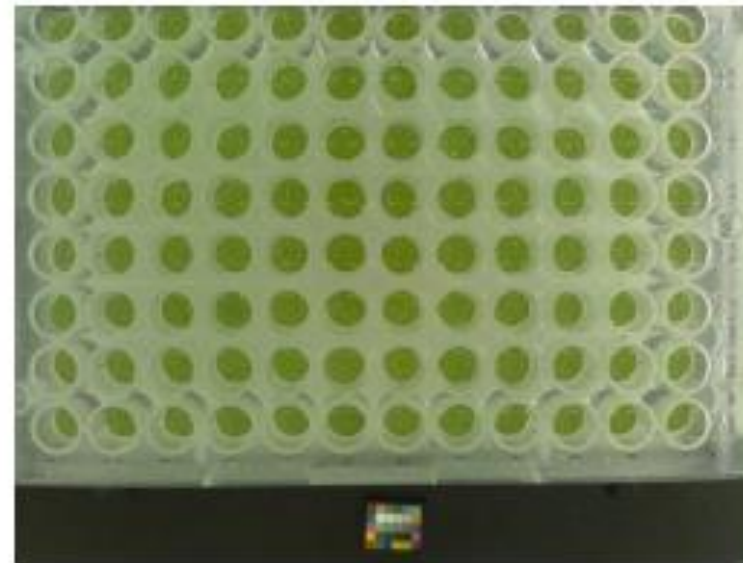
- Une diversité de questions ... besoin de prototypes à façon
- Une ambition de recherche translationnelle ... bas coût
- Une nécessité d'accessibilité ... des technologies open sources



Raspberry Pi Technology – dawn of cheap imaging



- Cameras are small and cable can go outside the cabinet (2m length).
- Cameras are available as visible light or full spectrum (IR)

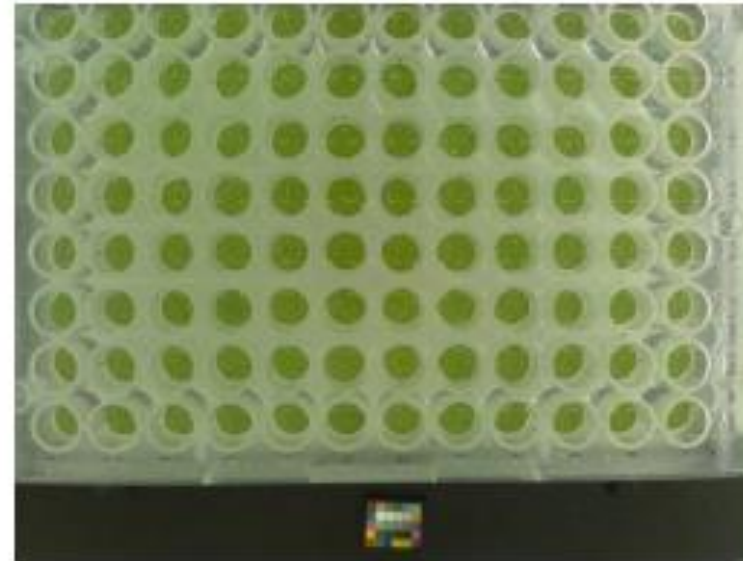


8MP output from the PI camera

Raspberry Pi Technology – dawn of cheap imaging



- Cameras are small and cable can go outside the cabinet (2m length).
- Cameras are available as visible light or full spectrum (IR)



8MP output from the PI camera

- Un réseau de caméras pour suivre les plantes en vue de dessus
- Créé par Pejman Rasti et David Rousseau en collaboration avec Julia Buitink and Olivier Leprince (IRHS), Arexhor ANR Labcom ESTIM, Daniel Prat Lyon 1, ...



Raspberry-Pi
RGB, IR cameras



Raspberry-Pi
RGB, IR cameras



Raspberry-Pi et optique
Adaptée (CTIS)



Raspberry-Pi
RGB, IR cameras



Raspberry-Pi et optique
Adaptée (CTIS)



Non raspberry-Pi camera
Connectée à un Raspberry-Pi



Raspberry-Pi
RGB, IR cameras



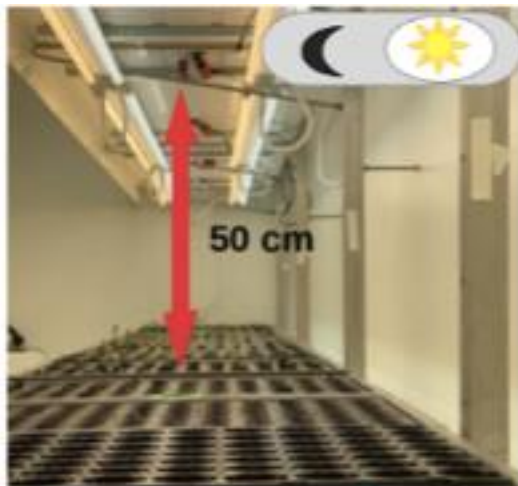
Raspberry-Pi et optique
Adaptée (CTIS)



Non raspberry-Pi camera
Connectée à un Raspberry-Pi



Milieu contrôlé



Raspberry-Pi
RGB, IR cameras



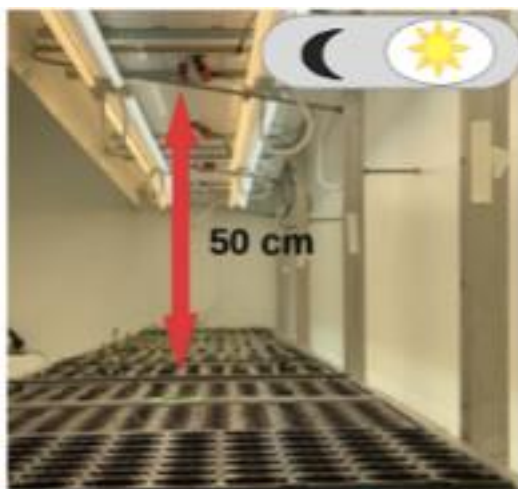
Raspberry-Pi et optique
Adaptée (CTIS)



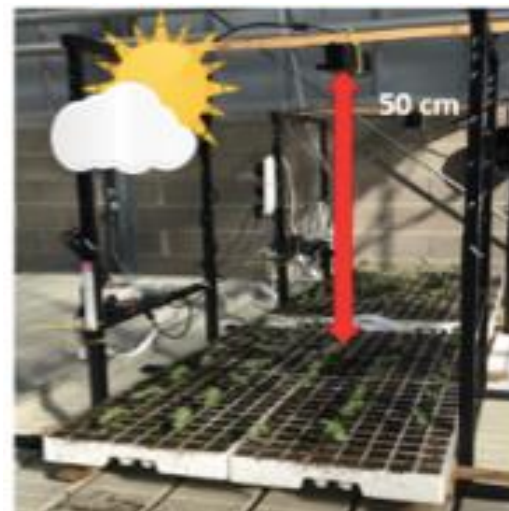
Non raspberry-Pi camera
Connectée à un Raspberry-Pi



Milieu contrôlé



Serres



Raspberry-Pi
RGB, IR cameras



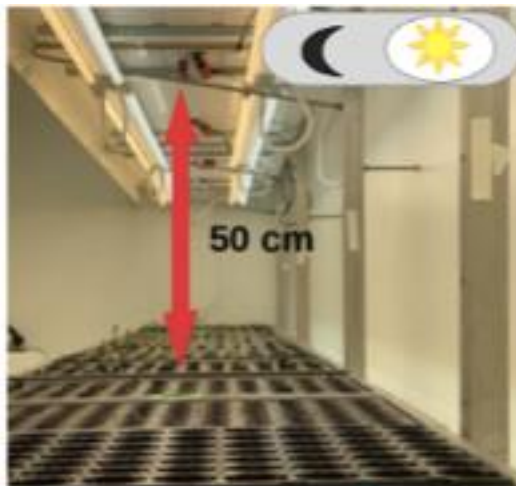
Raspberry-Pi et optique
Adaptée (CTIS)



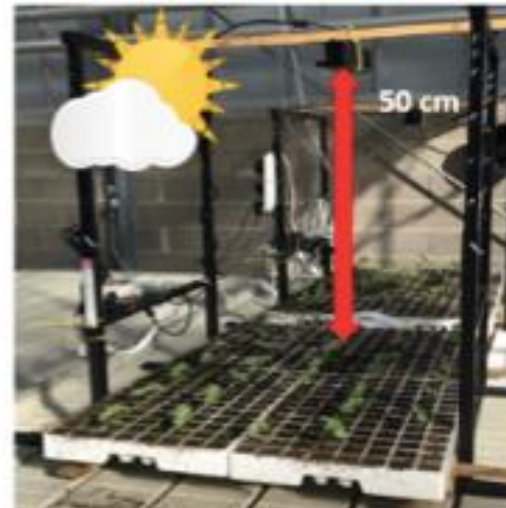
Non raspberry-Pi camera
Connectée à un Raspberry-Pi



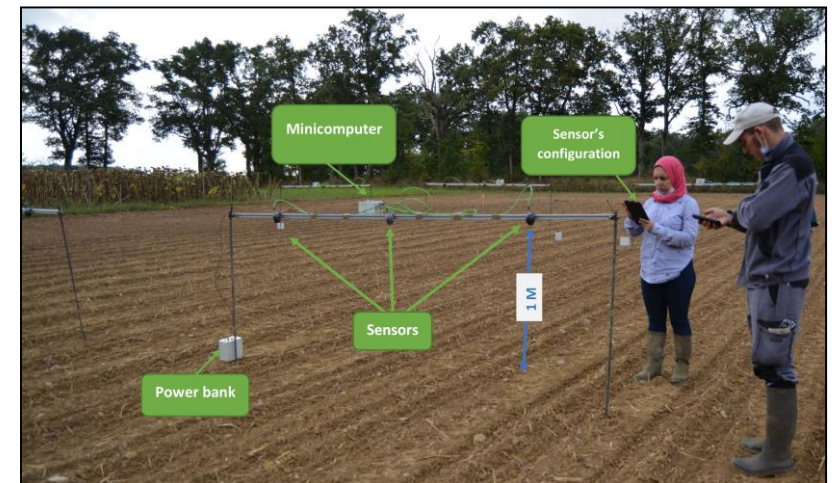
Milieu contrôlé



Serres



Parcelles



Sensor to plant

Pros:

Possibility of high resolution

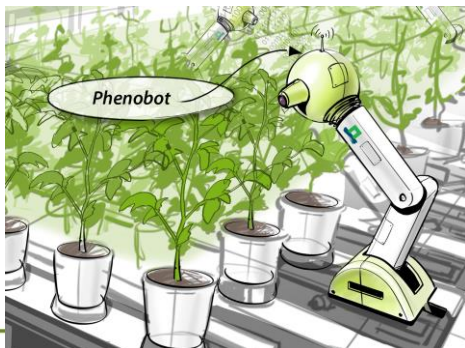
Specific light

Cons:

Non synchronized

Shadow of robotic sensor

Slow



plant to sensor

Pros:

High flexibility of measure

Specific light

Cons:

Non synchronized

Possibly invasive

Slow



Grid of sensor

Pros:

Synchronized

Fast

Non invasive

Integrated in CE

Cons:

Expensive except if low
Cost sensors

Sensor to plant

Pros:

Possibility of high resolution

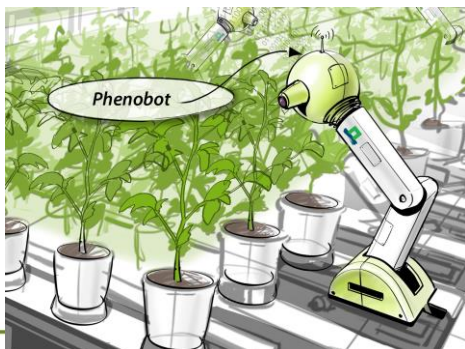
Specific light

Cons:

Non synchronized

Shadow of robotic sensor

Slow



plant to sensor

Pros:

High flexibility of measure

Specific light

Cons:

Non synchronized

Possibly invasive

Slow



Grid of sensor

Pros:

Synchronized

Fast

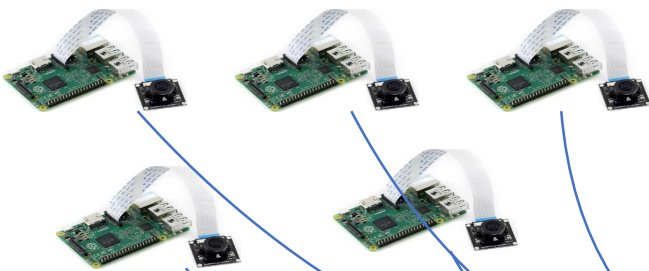
Non invasive

Integrated in CE

Cons:

Expensive except if low
Cost sensors

Chambre de culture ou serre



Subirrigation

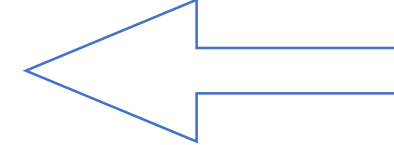


ou connection ethernet

Utilisateurs



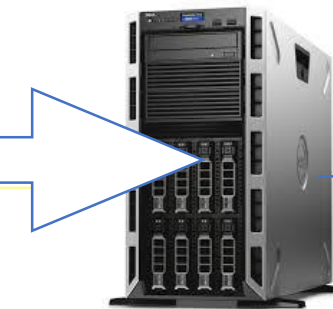
Data et connaissance



ImHorPhen



Serveur INRAe

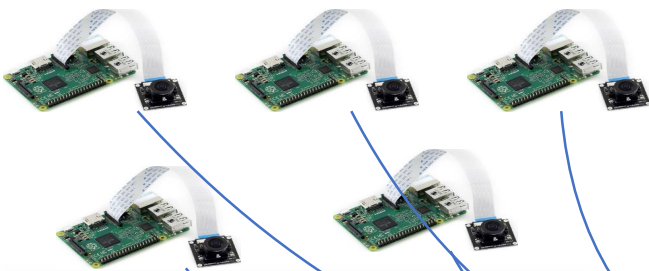


Serveur de délestage

Réseau INRAe



Chambre de culture ou serre



Subirrigation

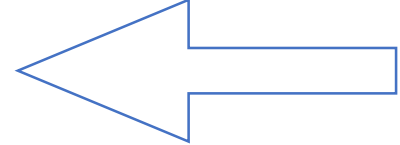


ou connection ethernet



Utilisateurs

Data et connaissance



Serveur INRAe

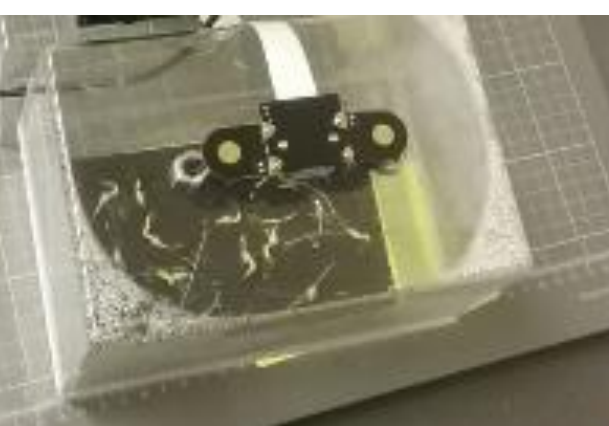


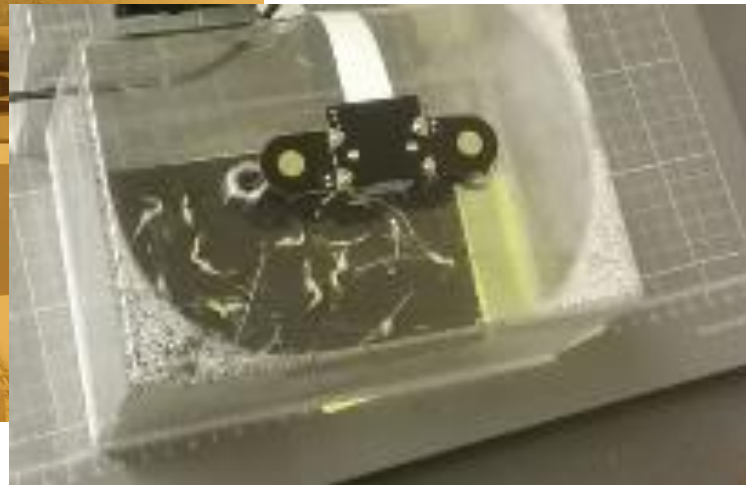
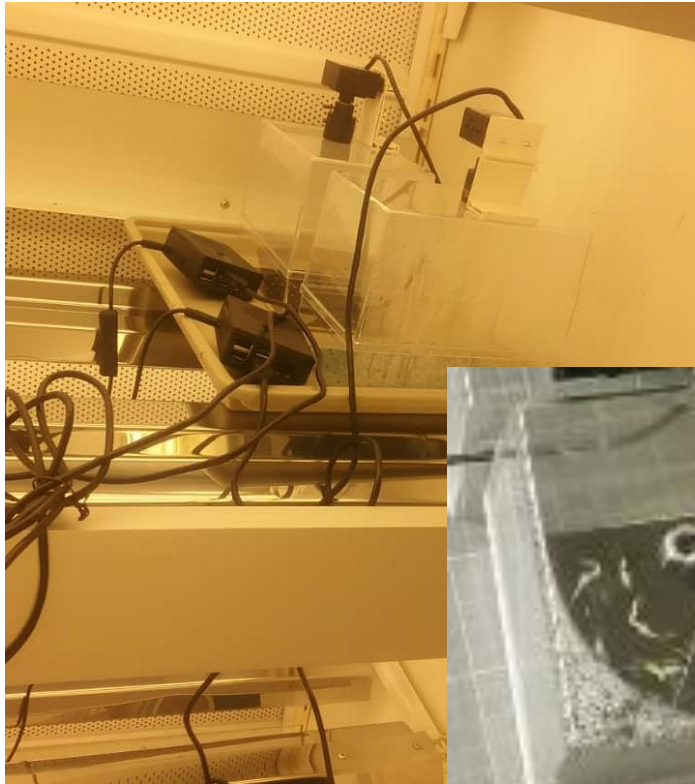
Serveur de déstaging

Réseau INRAe

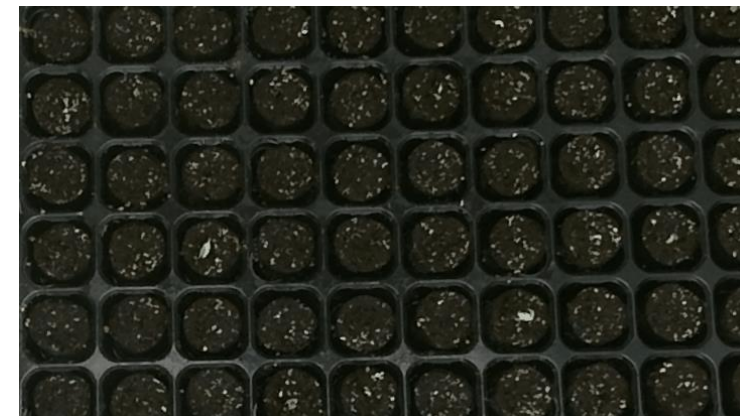
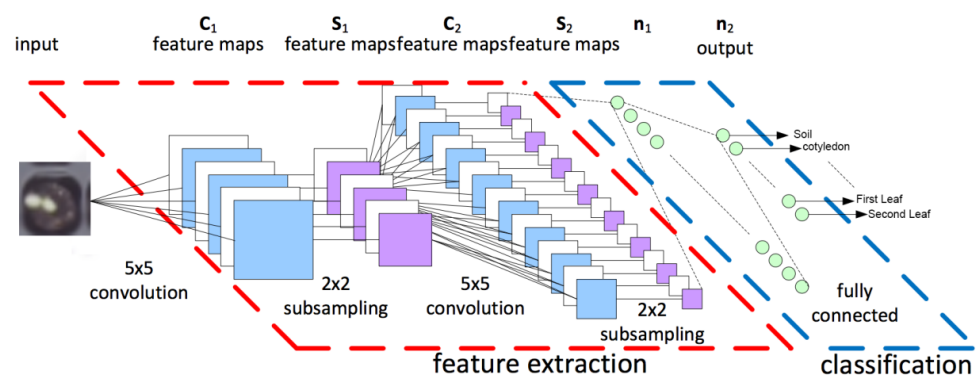
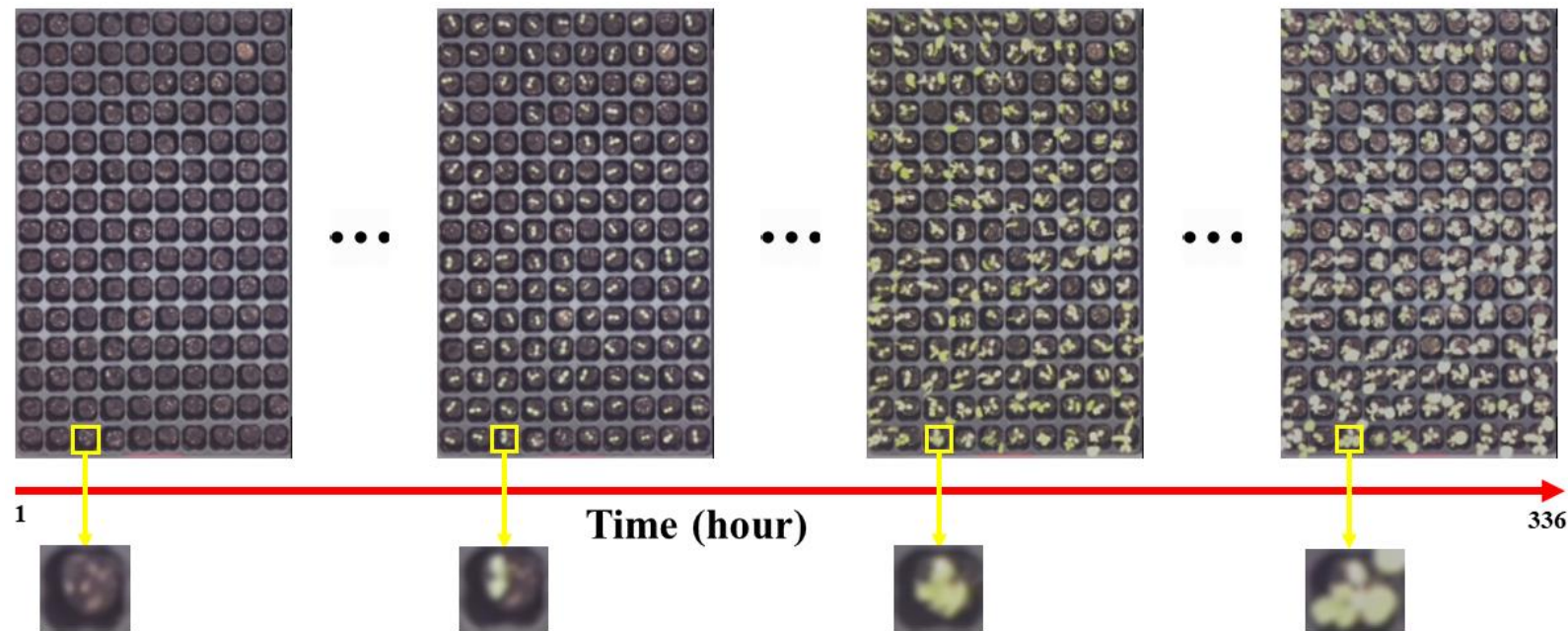


- Imbibition, germination de graines
- Emergence
- Processus de croissance
- Couverture au sol
- Quantification de la présence de pathogènes
- Reconnaissance d'insectes
- ...

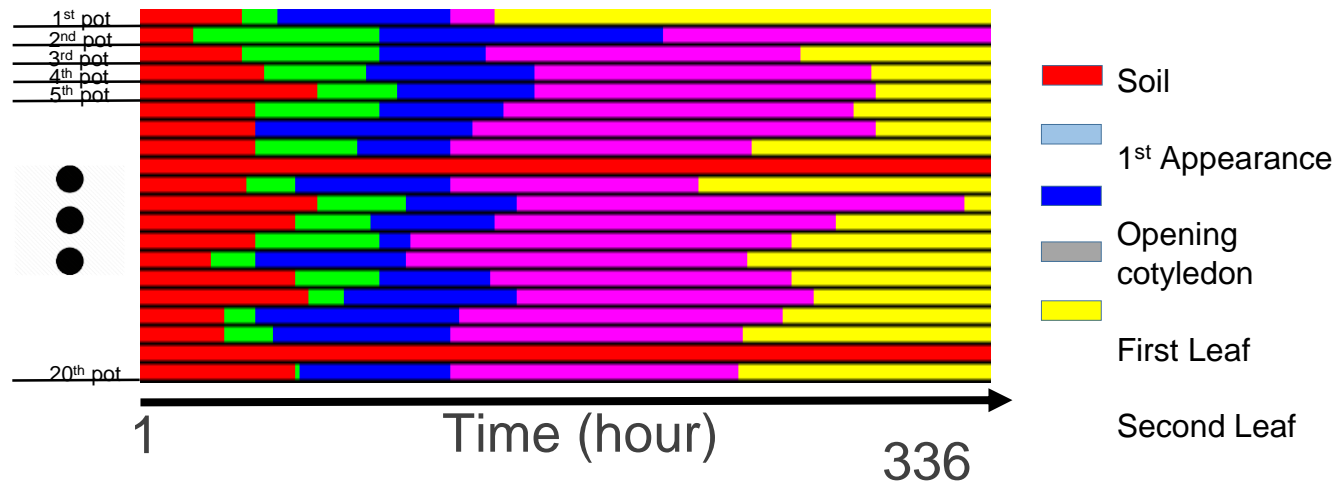
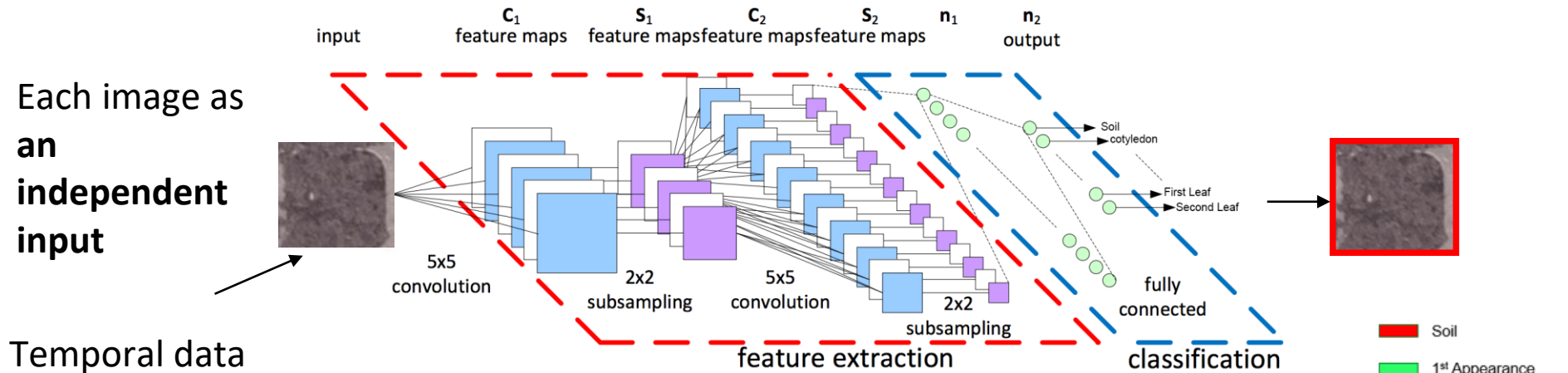


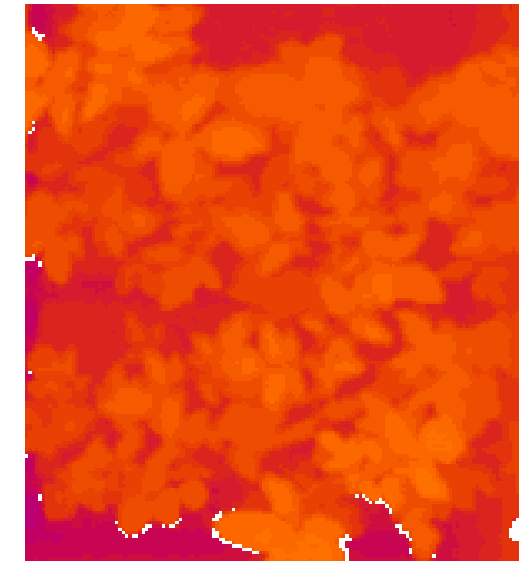
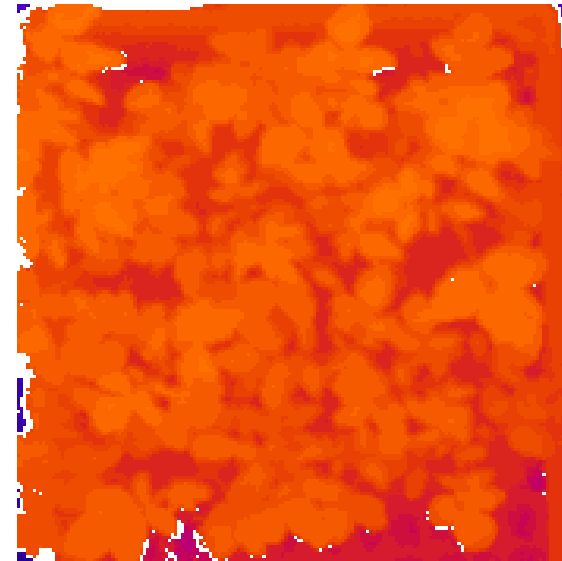
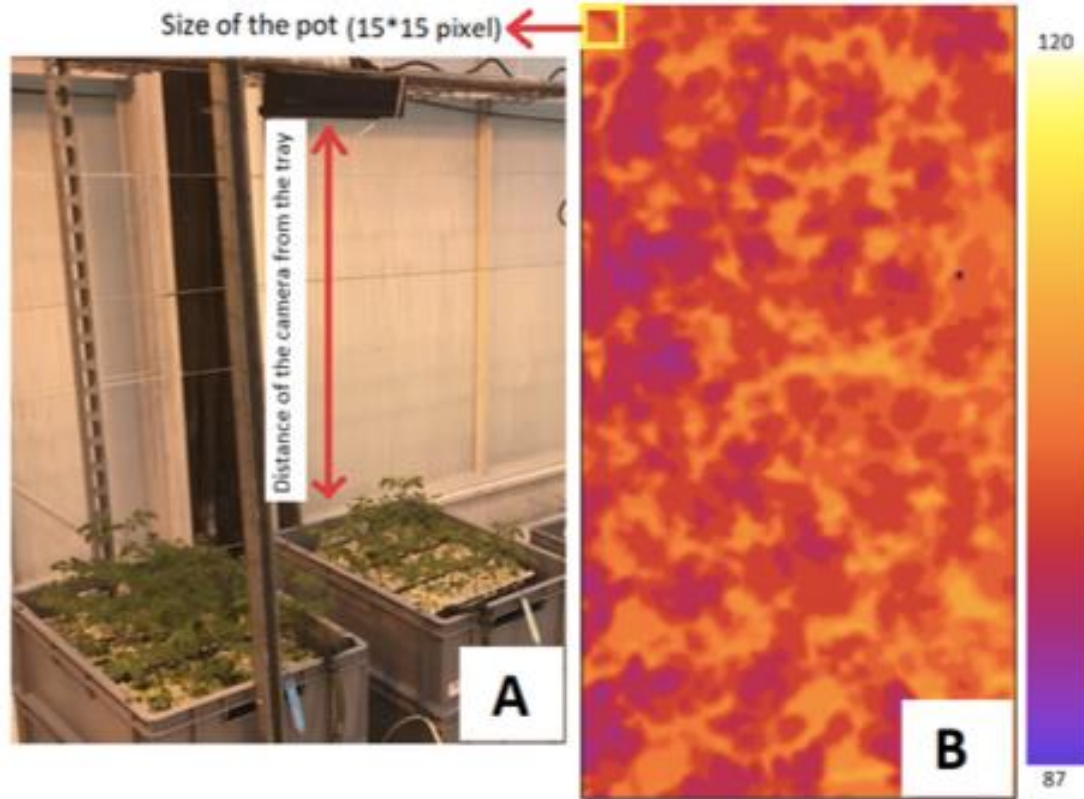


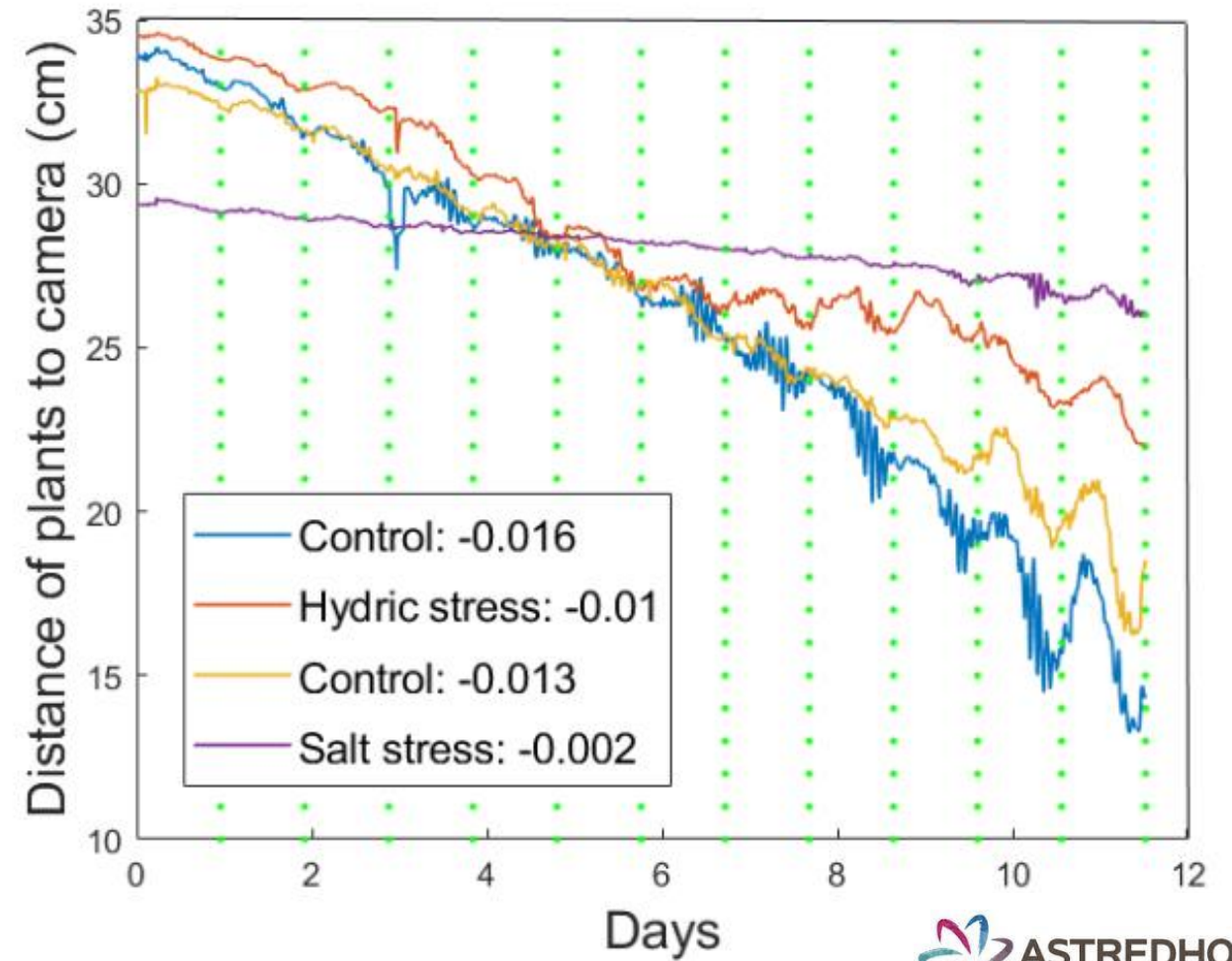
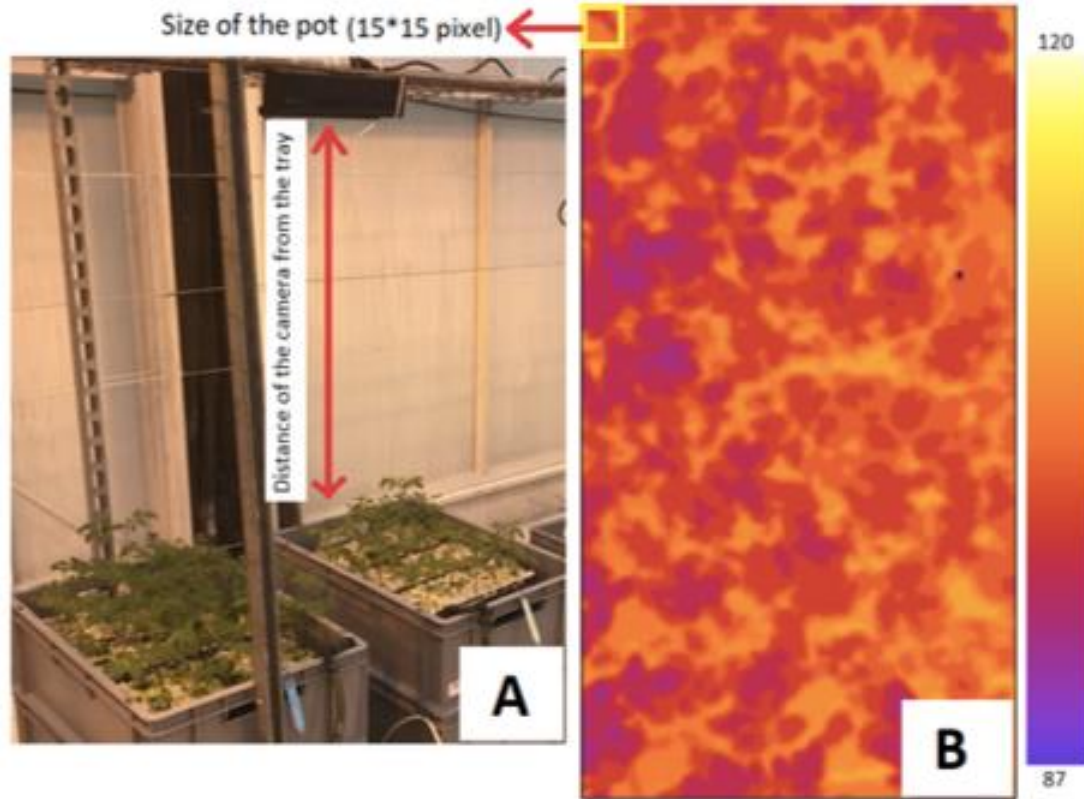
Détection de stades de croissance de plantules



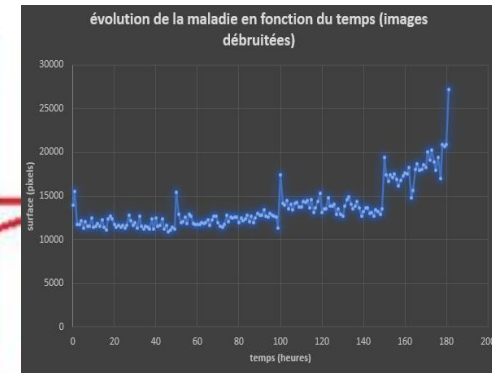
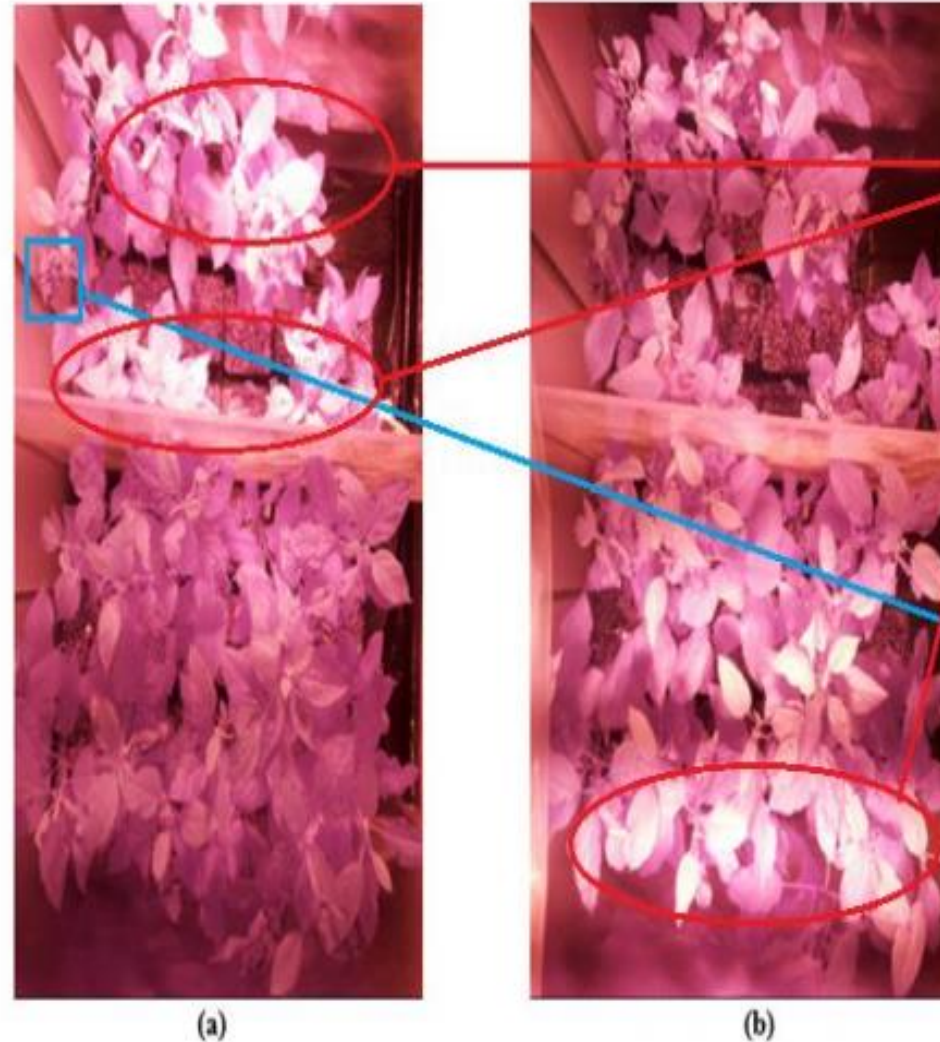
Accuracy: 98% of correct classification

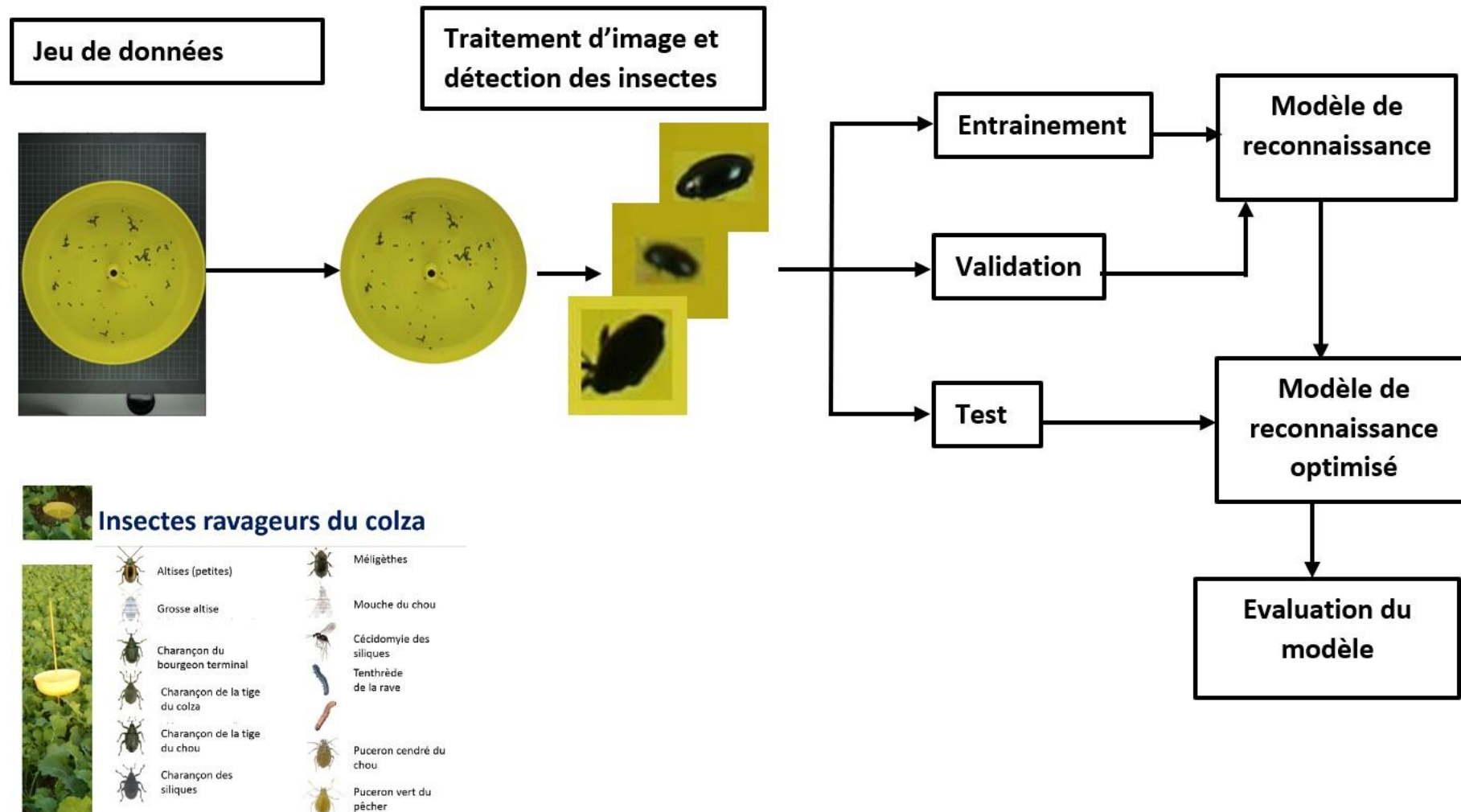






Feuilles individuelles avec occultations





Espèces	Nombre d'images	Nombre d'imagettes utilisées	Jeu d'entraînement (%)	Jeu de validation (%)	Jeu de test (%)
Charançon bourgeon terminal	26	400*5 = 2000	72%	8%	20%
Charançon siliques	18	400*5 = 2000	72%	8%	20%
Charançon Tige Chou	29	400*5 = 2000	72%	8%	20%
Grosses altises	24	400*5 = 2000	72%	8%	20%
Meligèthes	19	400*5 = 2000	72%	8%	20%
Petites Altises	33	400*5 = 2000	72%	8%	20%
Charançon tige de colza	71	400*5 = 2000	72%	8%	20%

$$Justesse = \frac{\text{Nombre de prédictions correctes}}{\text{Nombre de total prédictions}} = 93.86\%$$

Méthode	Espèces						
	PA CTCH	AH CTC	CS	ME	CBT		
Resnet50	93%	97.75%	90.75%	97.75%	88.75%	91.75%	97.25%

Petite altise	372	0	15	9	2	2	0
Altise d'hiver	0	391	0	0	0	2	7
Charançon des siliques	2	0	363	8	16	10	1
Meligèthe	0	0	2	391	3	4	0
Charançon bourgeon terminal	0	4	11	1	355	26	3
Charançon de la tige du chou	0	1	13	3	15	367	1
Charançon Tige Colza	0	3	1	0	4	3	389

Techno-providers



Instituts Techniques



Agro-entreprises





Contact

IRHS/Université d'Angers
42 rue Georges Morel
49071 Beaucouzé Cedex

* champs obligatoires

Votre courriel*

Destinataire*

Objet

Votre message*

Captcha*



Mise en contact avec expert responsable (D. Rousseau)

Un ingénieur pour le suivi de l'acquisition des données (G. Couasnet)

Un ingénieur pour le suivi des cultures (R. Gardet)

Expérimentation sur site PHENOTIC ou déploiement chez client

Variétés de contrats : Prestation, Collaboration, Projets étudiants,

Alternance, Thèse CIFRE, ...

Logiciel de pilotage : Growth Data

Image measures selection

File Process Options

color_al_2022_05_17_17_03.png

Selection coordinates :
No selection

How to proceed :
9. The measurements have been made. You can launch the predictions of the stages of evolution if the plants followed are beans by clicking on 'Make predictions' or export the files you need from the menu 'File'. To export measures, for example, you can do so via the menu 'File >> Export measures'.

Search trays
Search plants

Add label
Remove label

Unselect
Unselect all

Add plant template
Add tray template

Tray shift detection

Enhance contrast
Reduce contrast

Get Features
Start predictions
Color-Depth model
Impainted images

Image folder : /media/user/local/DATA/Geoffroy/Sucseed/GUI-Sucseed/images/
Image name : color_al_2022_05_17_17_03.png
Image Format : Portable Network Graphics (".png")
Shape (width x height) : 1920 x 1080 pixels
Image type : RGB 8 bits (24 bits/pixel)
Creation datetime : 2/6/2022 @ 8:43:28
Modification datetime : 18/5/2022 @ 1:2:14

Browse image directory :
Image directory
Start measures


2 opened files : [...]
'2022-05- ... ay2.xlsx'
Import Excel file
Images datetime

Color image 1 / 655
Go to image n° 0 OK
Previous
Next
Color/Depth
Reset

TI-32. Plants area : (890, 922) --> (958, 1000)
TI-33. Plants area : (959, 323) --> (1037, 401)
TI-34. Plants area : (959, 406) --> (1037, 484)
TI-35. Plants area : (959, 490) --> (1037, 568)
TI-36. Plants area : (960, 574) --> (1038, 652)
TI-37. Plants area : (960, 659) --> (1038, 737)
TI-38. Plants area : (959, 745) --> (1037, 823)
TI-39. Plants area : (960, 831) --> (1038, 908)
TI-40. Plants area : (959, 920) --> (1039, 1000)

Tray 2 - plants detection :
T2-1. Plants area : (1152, 307) --> (1260, 385)
T2-2. Plants area : (1156, 390) --> (1263, 468)
T2-3. Plants area : (1187, 473) --> (1267, 553)
T2-4. Plants area : (1181, 557) --> (1271, 637)
T2-5. Plants area : (1187, 644) --> (1275, 722)
T2-6. Plants area : (1202, 730) --> (1280, 803)
T2-7. Plants area : (1205, 817) --> (1283, 895)
T2-8. Plants area : (1210, 905) --> (1289, 985)
T2-9. Plants area : (1259, 303) --> (1339, 383)
T2-10. Plants area : (1264, 387) --> (1342, 468)
T2-11. Plants area : (1265, 470) --> (1345, 550)
T2-12. Plants area : (1271, 554) --> (1351, 634)
T2-13. Plants area : (1277, 641) --> (1356, 719)
T2-14. Plants area : (1281, 727) --> (1359, 805)
T2-15. Plants area : (1285, 815) --> (1364, 893)
T2-16. Plants area : (1291, 903) --> (1369, 981)
T2-17. Plants area : (1339, 300) --> (1417, 378)
T2-18. Plants area : (1345, 384) --> (1421, 462)
T2-19. Plants area : (1346, 467) --> (1425, 547)
T2-20. Plants area : (1352, 553) --> (1430, 631)
T2-21. Plants area : (1358, 639) --> (1436, 717)
T2-22. Plants area : (1362, 725) --> (1440, 803)
T2-23. Plants area : (1368, 813) --> (1445, 891)
T2-24. Plants area : (1373, 901) --> (1451, 979)
T2-25. Plants area : (1418, 297) --> (1497, 375)
T2-26. Plants area : (1422, 381) --> (1502, 461)
T2-27. Plants area : (1426, 465) --> (1506, 545)
T2-28. Plants area : (1439, 551) --> (1512, 629)
T2-29. Plants area : (1439, 637) --> (1517, 715)
T2-30. Plants area : (1444, 723) --> (1522, 801)
T2-31. Plants area : (1449, 811) --> (1527, 889)
T2-32. Plants area : (1454, 898) --> (1532, 977)
T2-33. Plants area : (1497, 293) --> (1577, 373)
T2-34. Plants area : (1503, 377) --> (1581, 455)
T2-35. Plants area : (1508, 463) --> (1586, 541)
T2-36. Plants area : (1513, 547) --> (1593, 627)
T2-37. Plants area : (1520, 635) --> (1598, 713)
T2-38. Plants area : (1523, 721) --> (1603, 801)
T2-39. Plants area : (1528, 807) --> (1608, 887)
T2-40. Plants area : (1534, 896) --> (1612, 974)

[Load Project] Loading measures from directory : /media/user/local/DATA/Geoffroy/Sucseed/GUI-Sucseed/measure/Room68/2022-05-17-INTELA/
[Load Project] Loading images stacks from directory : /media/user/local/DATA/Geoffroy/Sucseed/GUI-Sucseed/crop/Room68/2022-05-17-INTELA/
[Import image stacks] Import Successful color and depth image stacks from : /media/user/local/DATA/Geoffroy/Sucseed/GUI-Sucseed/crop/Room68/2022-05-17-INTELA/
[Load Project] Loading Impainted images from directory : /media/user/local/DATA/Geoffroy/Sucseed/GUI-Sucseed/impainting/Room68/2022-05-17-INTELA/
[Import impainted images] Import Successful impainted image stacks from : /media/user/local/DATA/Geoffroy/Sucseed/GUI-Sucseed/impainting/Room68/2022-05-17-INTELA/
[Load Project] Project imported without error !



GrowthData

HOME

GROWTH ANALYSIS OF PLANTS

Color images

Upload

Image analysis

Sequence analysis

Depth images

Upload

Sequence analysis

COLOR IMAGES

Upload

- Load the TIFF file to analyse from your local disk
- Resize, crop or rotate your images
- Watch images of the sequence

Image analysis

- Select an image of the sequence
- Decompose the 3 color layers of the image
- 3D decomposition of the image
- Create a segmentation mask of the plants
- Download your binary mask

Sequence analysis

- Evolution of the area covered by plants
- 3D Evolution of the average color
- Download the evolution of the canopy area

1

DEPTH IMAGES

Upload

- Load the TIFF file to analyse from your local disk
- Resize, crop or rotate your images
- Watch images of the sequence

Sequence analysis

- Evolution of the distance with the camera
- Represent your chosen features over time
- Download the evolution of the average depth

The screenshot displays the PHENOME online demonstrator interface. On the left is a dark sidebar with a 'GrowthData' logo and navigation options: HOME, GROWTH ANALYSIS OF PLANTS, Color images (with a '0/21/20' indicator), Upload, Image analysis, Sequence analysis, Depth images (with a '0/1/20' indicator), Upload, and Sequence analysis. The main area shows two panels. The 'COLOR IMAGES' panel has three sections: 'Upload' (Load TIFF file, Resize/crop/rotate, Watch sequence), 'Image analysis' (Select image, Decompose 3 color layers, 3D decomposition, Create segmentation mask, Download binary mask), and 'Sequence analysis' (Evolution of area, 3D Evolution of average color, Download canopy area evolution). The 'DEPTH IMAGES' panel has two sections: 'Upload' (same as color) and 'Sequence analysis' (Evolution of distance, Represent features over time, Download average depth evolution). A white number '1' is overlaid on the 'Image analysis' section of the 'COLOR IMAGES' panel.



ImHorPhen Bio imaging research group

@imhorphenbioimagingresearch95 301 abonnés 159 vidéos

ImHorPhen is a bioimaging, research group, headed by Prof. David Rouse... >

Abonné ▾

ACCUEIL

VIDÉOS

PLAYLISTS

COMMUNAUTÉ

CHAÎNES

À PROPOS



Vidéos ▶ Tout lire



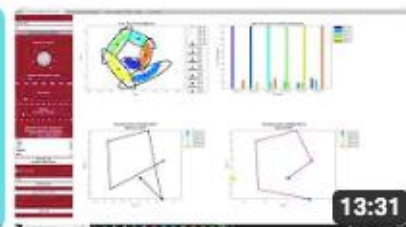
Container avec Docker

35 vues • il y a 6 jours



Container avec Singularity

13 vues • il y a 6 jours

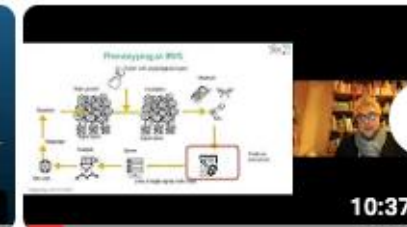


Ordinalysis tutorial

28 vues • il y a 12 jours



Acquisition d'objet 3D avec Range Vision



WEBINAR_VEGEPOLYS_2

49 vues • il y a 4 semaines

Merci pour votre attention



Prochain rendez-vous ?

Angers 26-27 Juin 2023 IPPN Affordable Phenotyping workshop

