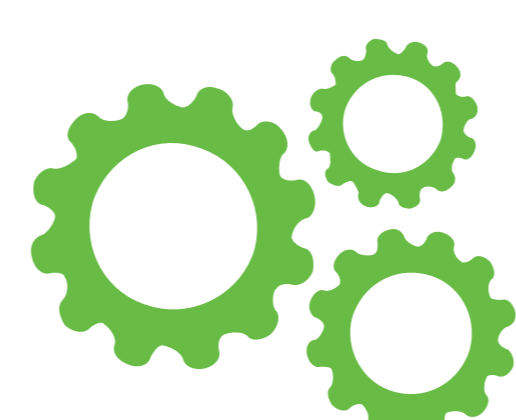**Nutrinnov Operational Group**

NutrInnov: Development of innovative decision support tools for the improvement of fertilization in two vegetable crops

NutrInnov: Développement d'outils d'aide à la décision innovants pour améliorer la fertilisation chez deux espèces légumières

Practical problem

Improve the management of the mineral nutrition of vegetable crops by setting up innovative diagnostic tools and relevant index.

Partners

Partner 1: GIE-SILEBAN, Gatteville Le Phare, France; Partner 2: UMR INRA/UCN 950 Ecophysiologie Végétale et Agronomie, Université de Caen, France.

Calendar

Start: 01/07/2018
End: 30/06/2021

Budget

Total amount:
€138,341

Objectives of the project

Our objective is to evaluate non-destructive and portable devices in order to develop new decision support tools enabling vegetable producers from Normandy to improve the management for N, P, K, S, Mg and B fertilizations of cabbage and carrot crops. Two optical sensors (a fluorimeter (Multiplex®) and a Near Infra-Red spectrometer (NIRS)), and one elemental analyzer (portable X-Ray Fluorimeter: XRF) will be tested under controlled and field conditions to develop relevant diagnostic methods for adjusting mineral nutrition. Our final goal is to propose new nutrient index that could be used by vegetable producers for the management of fertilization in a sustainable and economical manner.

Main activities

A first work package (2018-19) was performed under controlled conditions in order to study the specific impacts of N, P, K, S, Mg or B restrictions after a period of plethoric nutrition in cabbage and carrot crops. Non-destructive and portable devices will be adapted and optimized for each mineral deficiency and were compared to (1) the appearance of visual stress symptoms during development and (2) the measurements of mineral status with classical destructive methods (IRMS, ICP-MS). A second work package (2019-21), will be performed under field conditions in order to test the most promising tools and associated index.

Expected results

The level of maturity/feasibility of simple, accurate and repeatable measurements of nutrient levels in plant tissues will be identified in carrot and cabbage in accordance with the 4R concept i.e. the Right fertilizer source at the Right rate, at the Right time and in the Right place. Compared to current practices leading to approximate and excessive fertilizer inputs, the development of these innovative diagnostic tools, based on precision agriculture, will help to promote the image of farms by better monitoring their environmental and economic performances in terms of mineral use efficiency, profitability and sustainability.
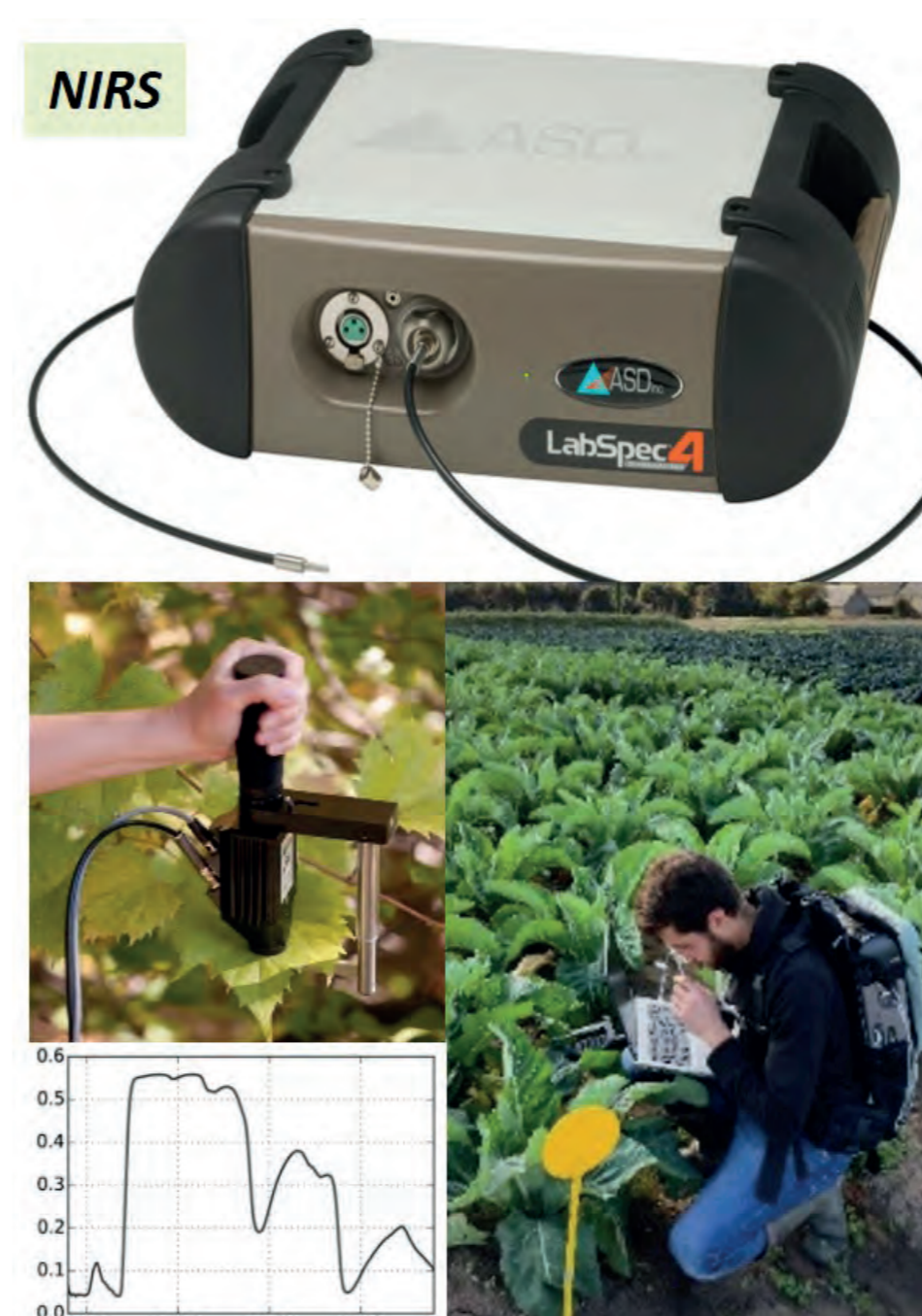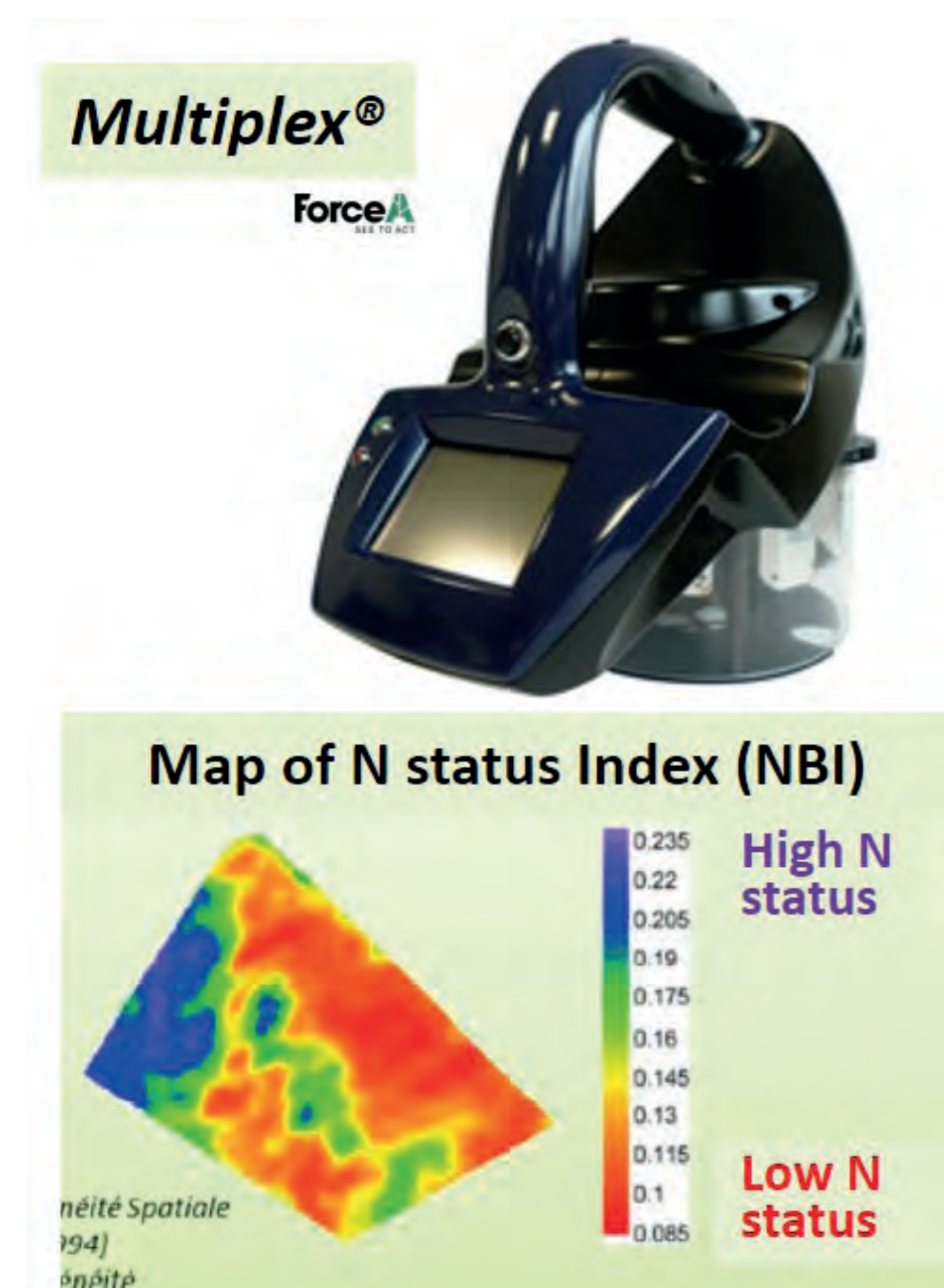
Results so far/first lessons

Based on the chlorophylls, flavonols and anthocyanins index given by a fluorimeter (Multiplex®), first results under greenhouse revealed that N deficiency (carrot and cabbage) and S deficiency (carrot) can be detected specifically and before the appearance of visual symptoms. Portable XRF (pXRF) also appears as a relevant tool to diagnose K and S deficiencies in young leaves of carrot and cabbage. For both species, the NIRS data reveal different behaviours depending on (1) the mineral deficiency and (2) the leaf rank measured. These promising tools will be tested under field conditions in order to confirm their use for the diagnosis of mineral status and fertilization management.

Who will benefit

The first results of this project will be intended for vegetable producers in Normandy (Department of Manche), who seek to optimize their production and improve their practices. The technical actors of the sector working closely with the producers (technicians of producer organizations, technical advisers…) will also be strongly concerned by this project. By extension, the information obtained at the end of this project can also serve as a basis for companies involved in R&D for future projects oriented towards optimizing fertilization management, as well as for private sector players, both at the national and international levels.

Supported by: UNICAEN UNIVERSITÉ CAEN NORMANDIE; EVA Ecophysiologie Végétale, Agronomie & nutrition N.C.S UMR INRA/UCN 950 EVA; SILEBAN; Jardins de Normandie; G.P.L.M; RÉGION NORMANDIE; UNION EUROPÉENNE Fonds européen agricole de développement rural: L'Europe investit dans les zones rurales

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Multiplex® ForceA

Map of N status Index (NBI)
High N status
Low N status

XRF

El	Min	%	Max	+/-
Fe	66.35	71.20	74.00	0.37
Cr	18.00	19.05	20.00	0.16
Ni	8.00	8.36	10.50	0.16
Mo	0.00	1.22	2.00	0.09
Cu	0.00	0.17	0.50	0.03
Mo	0.00	0.13	0.50	0.01
Co		0.28		0.03

NIRS