23 years of belgo-chinese collaboration to build Vigimap, an efficient and versatile potato late blight DSS, now spreading to more countries

Euroblight workshop – May 15th 2024

Bonnave M., Zhang J. , Vryghem C. , Couvreur B. , Mahieu O. , Che X. , Serneels F.

HSJD

AsiaBlight
Potato late blight network for Asia

Province de HAINAUT

Carah
CENTRE POUR L'AGRONOMIE
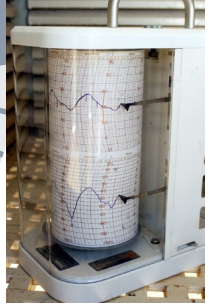ET L'AGRO-INDUSTRIE
DE LA PROVINCE DE HAINAUT

CARAH asbl

Agri-Food Research and Extension center
of Hainaut Province of Belgium

- Field trials and warnings for all local crops
- Important focus on potato

- In charge of potato late blight DSS for Wallonia

- Integrated farmer's support
- Attached to CONDORCET university college

Potato area 2022
- 0 - 5000
- 5000 - 10000
- 10000 - 15000
- 15000 - 20000
- 20000 - 23532
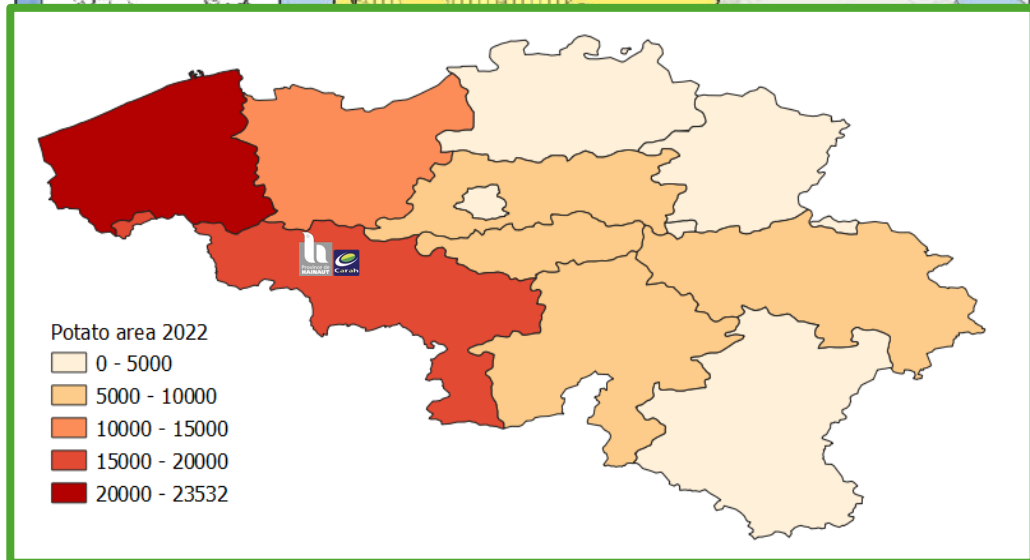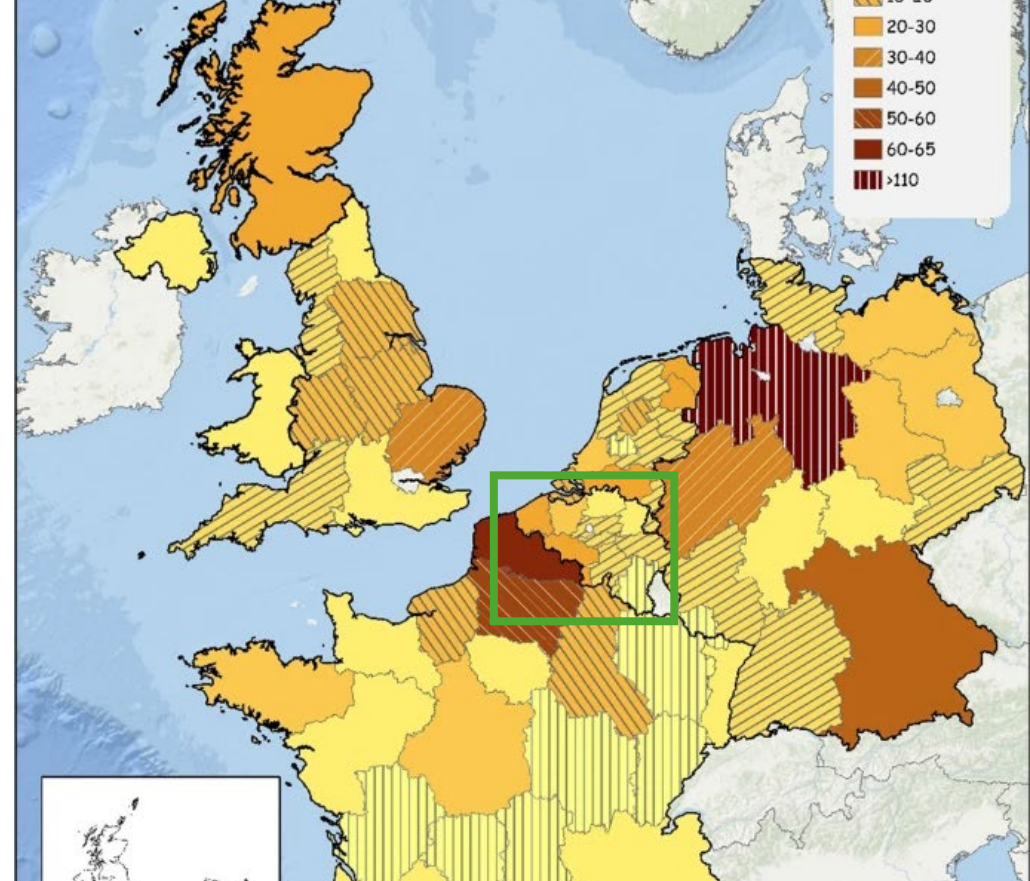
Brief history of CARAH DSS

François Serneel's first contacts with Xie Kaiyun from CIP – China and Che Xingbi from Plant protection station

First automated weather station in China

Pilot projects in Rwanda, Bangladesh and Guinea

Almost 1400 weather stations in China

Daily data
Post mail

Warning by fax

1999

2011

2022-23 **2024**

1986

1992

2008

Warning by Email and SMS

2019 **2020**

Started by Christian Ducatillon

10 automated weather stations

Service extended to Wallonia 30 weather stations managed by Pameseb - CRAW

Launch of VigiMAP

Farmers input data and consult model by themselves

Private weather stations compatibility

Adapted from Guntz and Divoux model

Continuous improvement of parameters based on results of field trials

Implementation of varietal susceptibility

Implementation of fungicide protection

2001 : First publication in Chinese

**POTATO LATE BLIGHT WARNING SYSTEM IN BELGIUM
AND ITS APPLICATION IN CHINA**

XIE Kai-yun   *CHE Xing-bi*
(Institute of Vegetables and Flowers, CAAS, Beijing, 100081; Chongqing Plant Protection and Quarantine Station, Chongqing, 400020)

DUCATILLON, Christian and SERNEELS, Francois
(C·A·R·A·H—Ferme Experimentale et Pedagogique, 301, rue de l'Agriculture—7800 ATH, Belgium)

First validation in Wuxi County, Chongqing

Since then, 17 publications in Chinese, validating the model in various regions of China

Liu Hao, Zhang Zongshan. Belgium CARAH Potato Late Blight Prediction Model Application in the southern mountainous area of Ningxia. Anhui Agricultural Sciences, 2008, 36

Tan Jianrun, Yuan Wenbin, Wu Haiyan, et al. The early warning system of potato late blight. Advances and Applications [J]. Southern Agriculture, 2011 (5): 61-63

Dong Fenglin, Guo Zhiqian, Liu Bingyi, et al. Using early warning systems to guide Daejeon Chemical control of potato late blight [J]. China Potato, 2013, 27 (3): 172-174

Li Honghao, Zhang Hong, Li Huapeng, et al. CARAH early warning of potato late blight Application of the model to Sichuan spring potato ［J］. China Agricultural Science Bulletin, 2017, 33(4): 136-141

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A few results in China

Evaluation on the application of CARAH monitoring and early warning model for potato late blight in Heilongjiang Province   Min et al. 2021. Chinese agricultural sciences bulletin

93 % accuracy of CARAH model to observed infections

Treatement	Number of sprays	AUDPC	Fungicide cost (€/ha)	Net income of farmer (€/ha)
Control	0	12,25 b	0	0
According to Carah model	7	1,08 a	450	1566
According to Negfry	8	1,11 a	578	1299
Spray every 7 days	10	1,27 a	642	1248
Spray every 10 days	9	1,85 a	514	1002

Market price of potato = 140 €/T

Date of observation
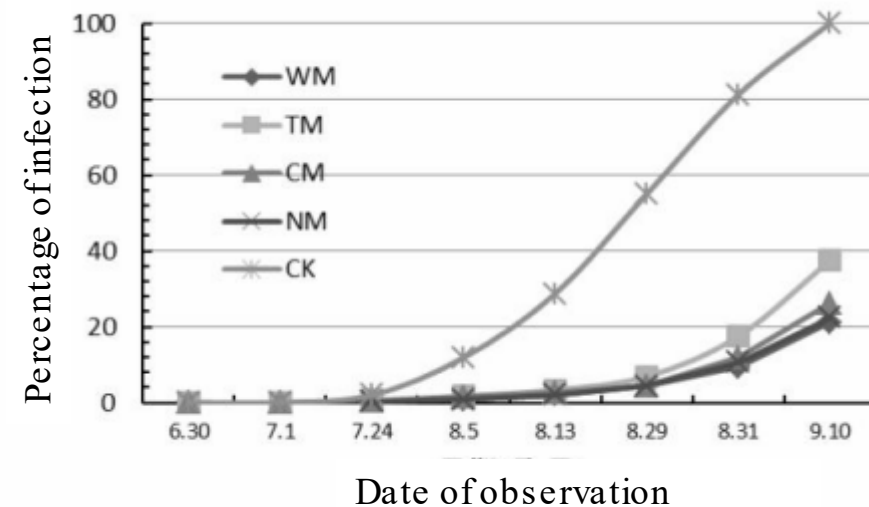
A few results in China

Green prevention and control of potato late blight and ecological environment protection in Sichuan Province

Wang et al. 2018 Acta Agronomica Sinica

CARAH model predicted first infection occurrence within a max 2 days range in 7 seven differents counties, different planting time and climatic zones

Place	Sowing time	CARAH model prediction	Observed first symptoms
Xuyong	Early March	May 31	May 30
Zhaojue	Early March	June 6	June 8
Pi	End of September	October 31	October 31
Daofu	End of April	July 3	July 5
Wanyuan	End of January	May 1	May 3
Pengshan	Early December	April 6	April 8
Pengzhou	End of February	April 30	May 2

Created with mapchart.net

A few results in China
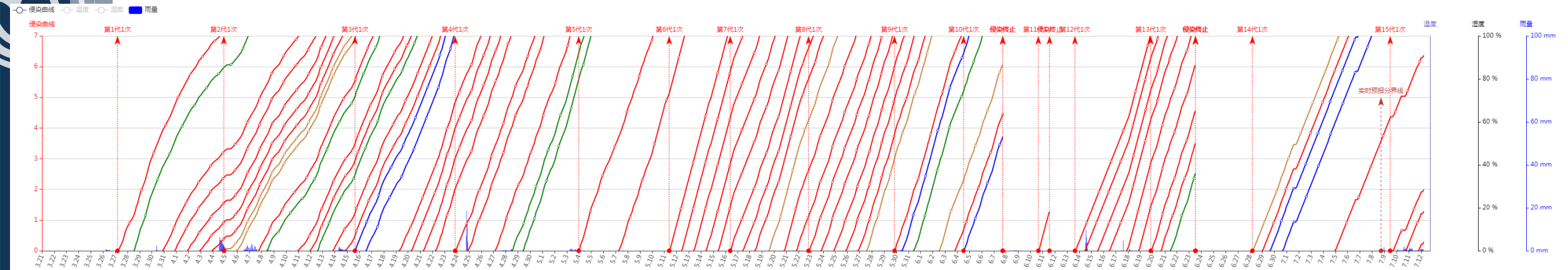
Xiao Chunfang, Enshi Southern China potato research center, 2021

	Number of fungicides used	Disease index	Yield (T/ha)	Yield increase (%)	Income (€/ha)
Integrated control (PLB warning)	5	5.24	30,7	94.89	8794
Conventional control (farmer)	3	65.91	15,7	-	4512

Price of potato = 285 €/T

3G网络传播
GPRS无线传播
云技术传播

Web客户端

气象监控设备 **1**

数据采集分析系统 **2**

数据浏览发布 **3**

手机客户端

使用系统效果

未使用系统效果

Evolution of the number of weather stations

Number of weather station with CARAH model in China

Coverage of chinese potato production zones by CARAH model in 2024 : 1400 stations
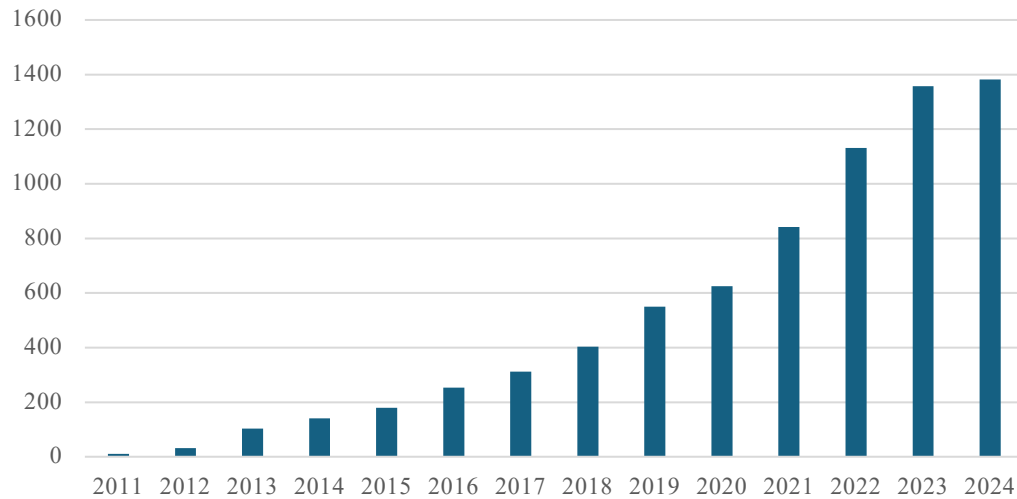
Back to 2017

- System in Wallonia is computerized but needs a major upgrading to allow farmer's input, private weather stations, …

- System in China is computerized, critical mass allows full time IT scientists to work on improving it, but is still very simple

Agronomical and extension knowledge

Information Technology

2019 : Lauch at Potato Europe

Farmers receive timely warnings written by CARAH agronomist

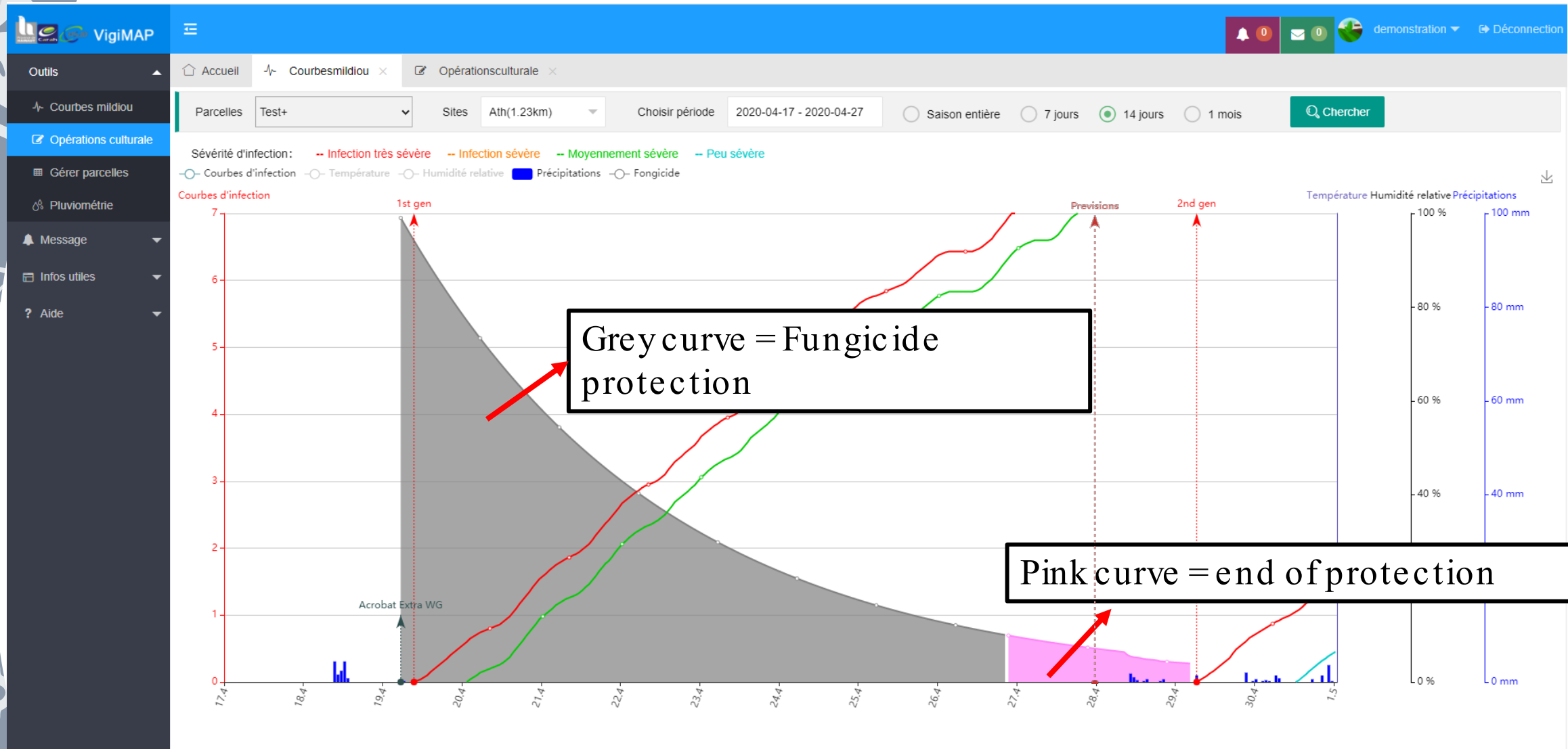Chat with expert

Field management tools

Semi automatized warning

Fungicide protection curves and properties

Grey curve = Fungicide protection

Pink curve = end of protection

New modules every year / projects and partners

Spatialization of weather data

CRA-W D2-U6
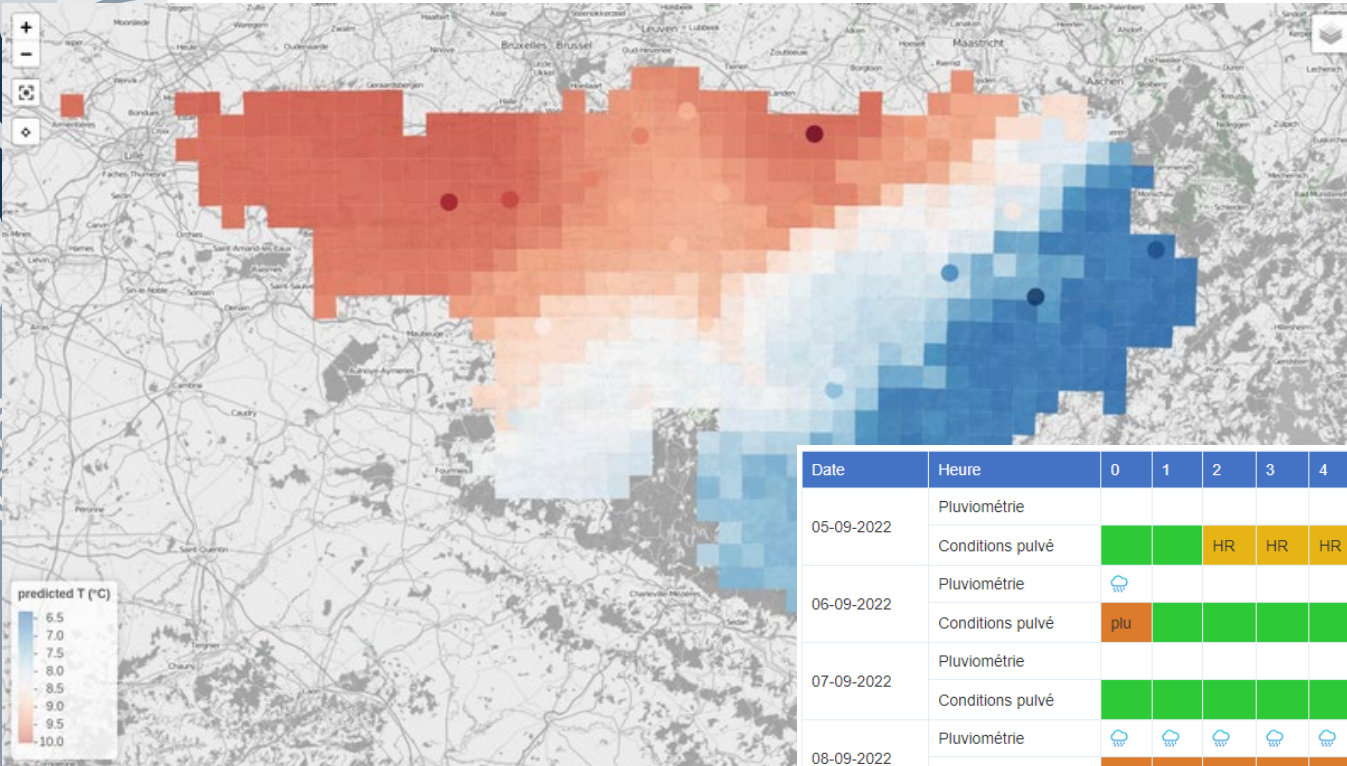
Date	Heure	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
05-09-2022	Pluviométrie																								☔
	Conditions pulvé			HR	HR	HR		HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR				plu
06-09-2022	Pluviométrie	☔										☔		☔					☔						
	Conditions pulvé	plu										plu	HR	plu	HR	HR	HR	HR	plu						
07-09-2022	Pluviométrie											☔	☔											☔	☔
	Conditions pulvé											plu	plu	HR	HR	HR	HR	HR	HR	HR				plu	plu
08-09-2022	Pluviométrie	☔	☔	☔	☔	☔		☔				☔	☔	☔	☔	☔	☔	☔	☔	☔					
	Conditions pulvé	plu	plu	plu	plu	plu		plu				plu	plu	plu	plu	plu	plu	plu	plu						

Légende code couleur
- Conditions optimales
- Conditions correctes
- Conditions limites
- Application déconseillée
- Application interdite

Principal élément limitant
- vvt Vent
- HR Humidité relative
- T Température

OAD issu d'une collaboration entre:

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SprayVision spraying time management tool

A few figures on VigiMAP in Wallonia

Province	VigiMAP covered area	Total cultivated area	Ratio
Hainaut	10927	18899	58 %
Liège	2236	7216	31 %
Namur	2200	6715	33 %
Brabant Wallon	1054	6821	15 %
Wallonia	16880	43614	39 %

An important number of farmers still only rely on the warning message, which is informally shared by farmers and farm advisers
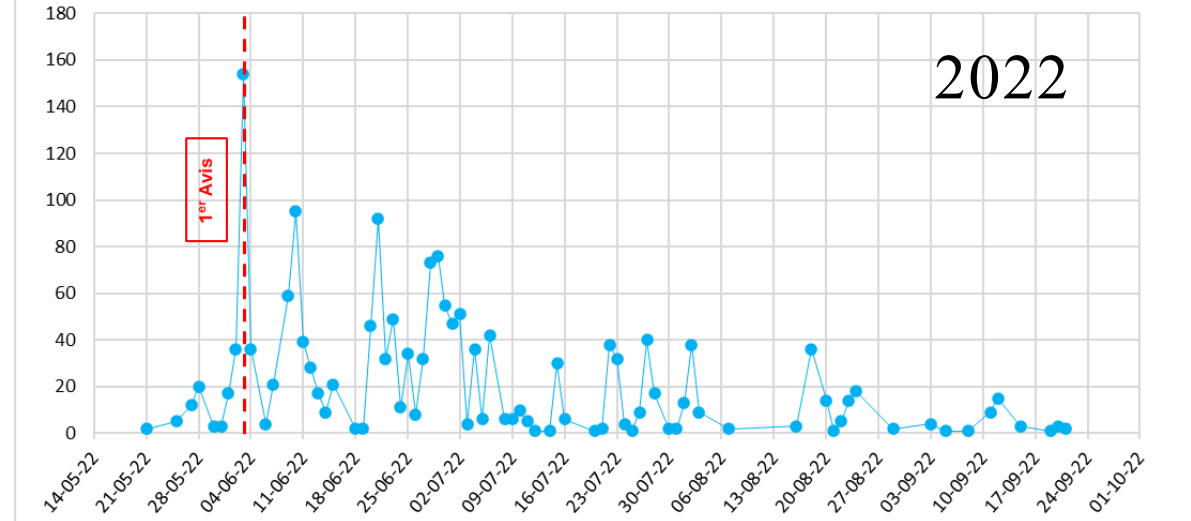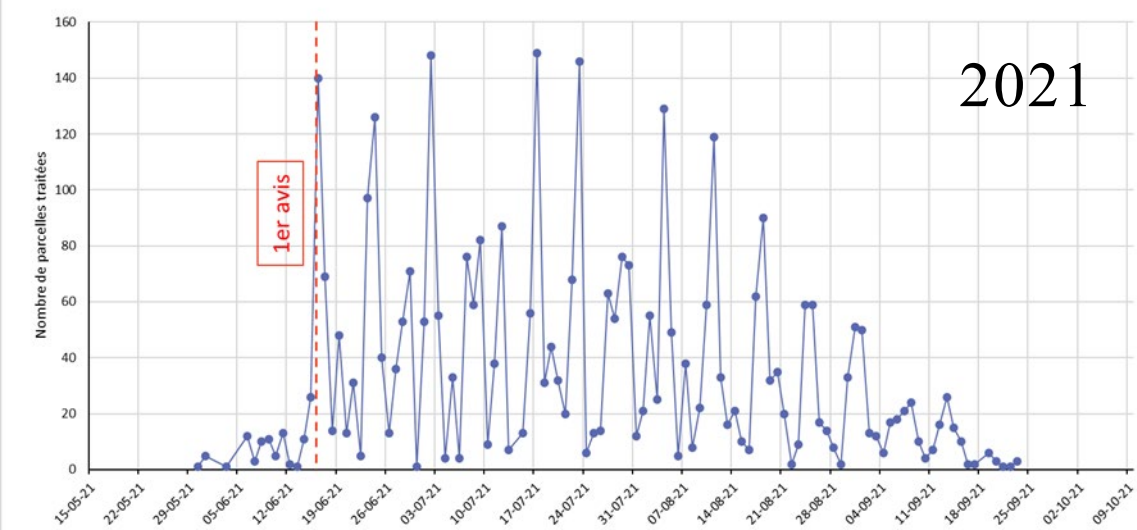
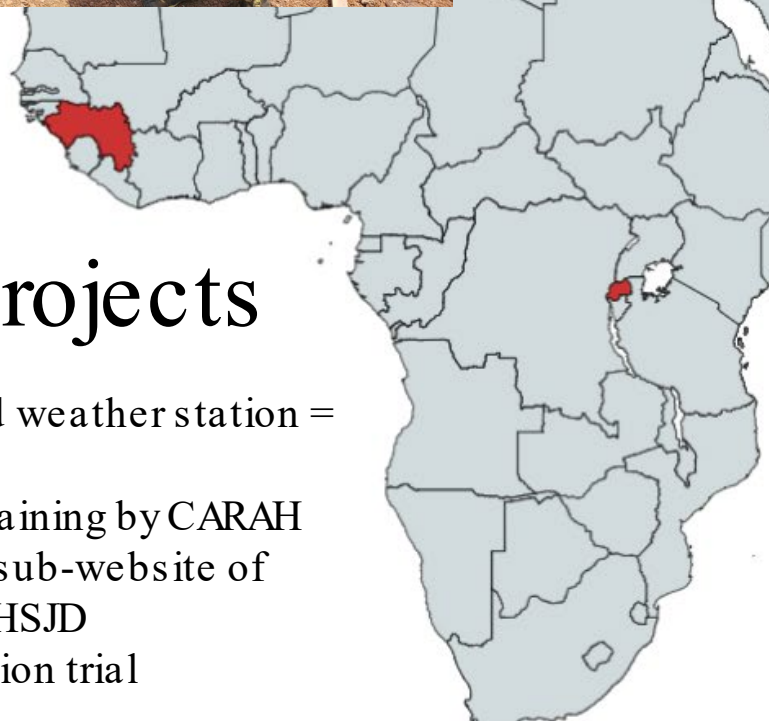# Farmers spraying input in VigiMAP
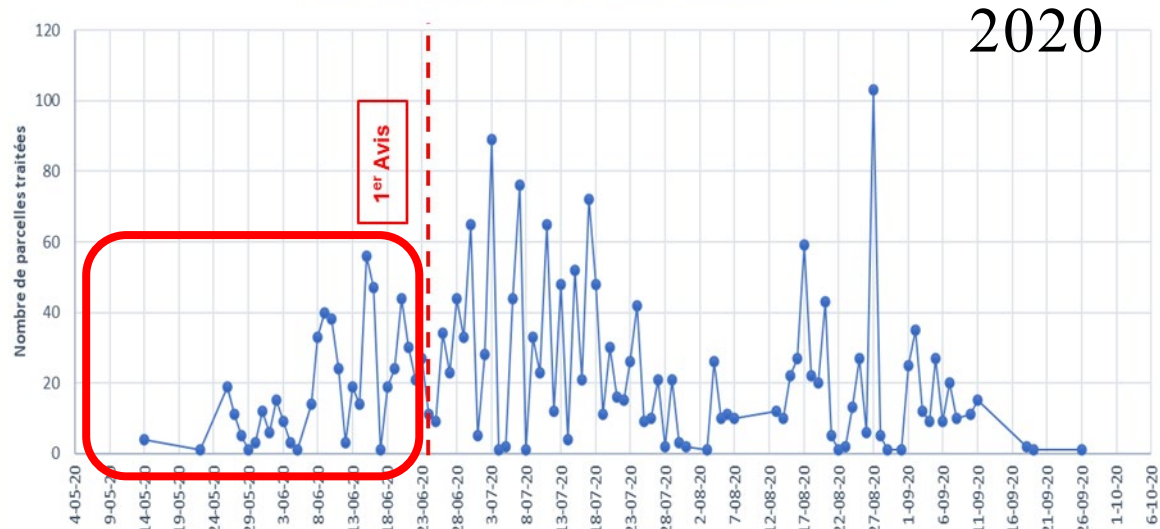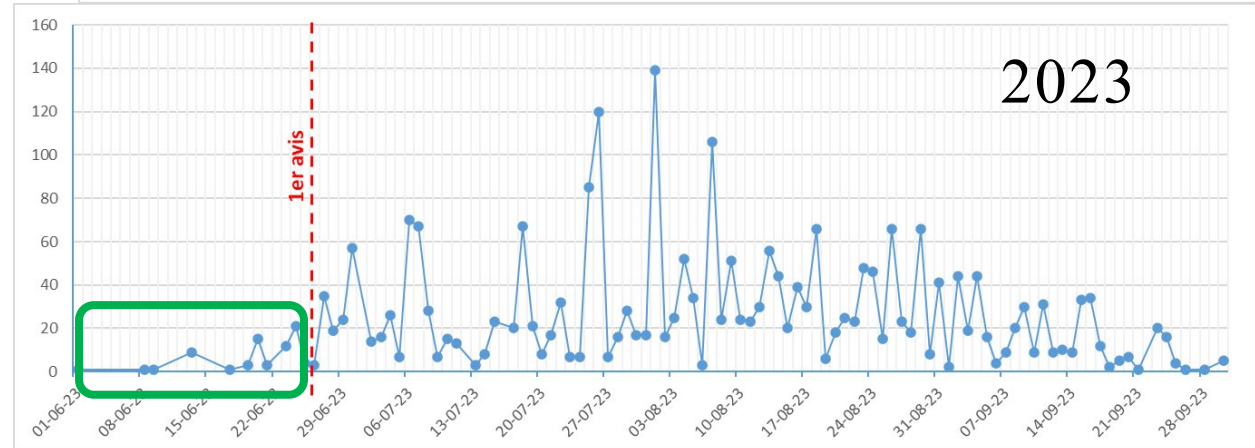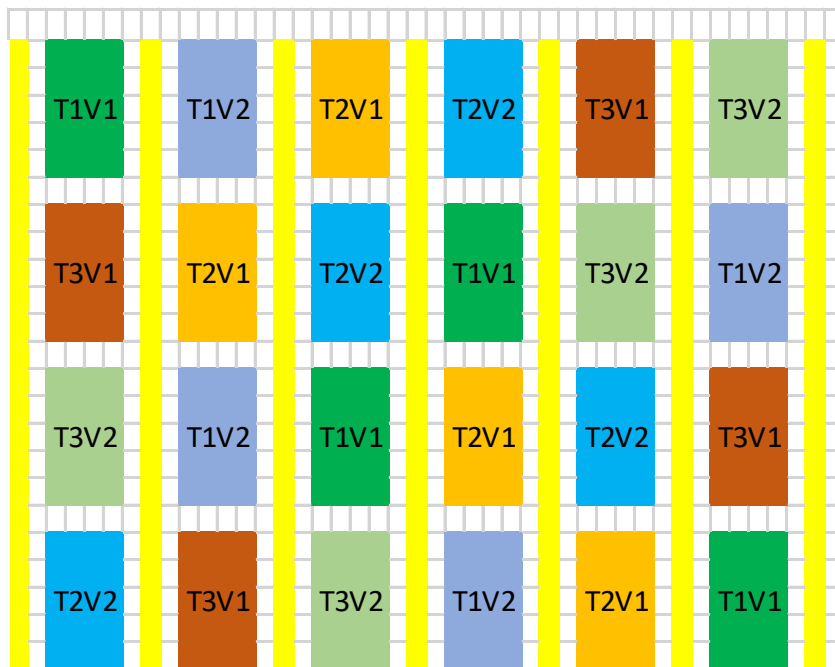
Guinea

Bangladesh

Rwanda

Pilots projects

- 1 connected weather station = 3500 €
- One week training by CARAH
- Creation of sub-website of VigiMAP by HSJD
- Field validation trial

Bangladesh

T1V1	T1V2	T2V1	T2V2	T3V1	T3V2
T3V1	T2V1	T2V2	T1V1	T3V2	T1V2
T3V2	T1V2	T1V1	T2V1	T2V2	T3V1
T2V2	T3V1	T3V2	T1V2	T2V1	T1V1

Treatments:
T1 = Untreated control
T2 = Spray according to Apex conventional practices
T3 = Spray according to CARAH warning system
█ **Contamination rows = untreated Santana (V2)**

Two varieties:
 V1 = Sunshine
 V2 = Santana

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Cost-benefit analysis of different treatment for Sunshine variety:

Treatments	Yield (t/ha)	Gross return (Tk/ha)	Production cost (Tk/ha)	Treatment cost (Tk/ha)	Total production cost (Tk/ha)	Net return (Tk/ha)	Benefit-cost ratio
T1	13.67	382860	200000	0.00	200000	182860	-0.91
T2	43.59	1220520	200000	76800	276800	943720	3.40
T3	43.54	1219120	200000	44800	244800	974320	3.98

Cost-benefit analysis of different treatment for Santana variety:

Treatments	Yield (t/ha)	Gross return (Tk/ha)	Production cost (Tk/ha)	Treatment cost (Tk/ha)	Total production cost (Tk/ha)	Net return (Tk/ha)	Benefit-cost ratio
T1	18.94	530320	200000	0.00	200000	330320	1.65
T2	45.90	1285200	200000	76800	276800	1008400	3.64
T3	46.01	1288280	200000	44800	244800	1043480	4.26

Price: Potato Tk 28/kg, Fungicide Tk 800/kg, Dose: Fungicide 8 kg/ha.

BCR = AXC-B/B
Where, A= selling price,
B = Total costs (Production + PLB management cost) and
C = Yield (t/ha)

T_1 = Untreated control
T_2 = Spray according to Farmers conventional practices
**T_3 = Spray according to CARAH warning system**

Integration of potato late blight forecast warning system into the Meteo Rwanda platform for potato farmers in Rwanda

Table 3: Pesticide application calendar per treatment

Dates of application	T2	T3
26/10	V	
3/11	V	
8/11		V
10/11	V	
17/11	V	
23/11	V	
24/11		V
1/12	V	
8/12		V
10/12	V	
14/12		V
17/12	V	
20/12		V
Total	8	5

Farmer practices   VigiMAP

LB progress curve

Untreated control

Farmers practice

VigiMAP
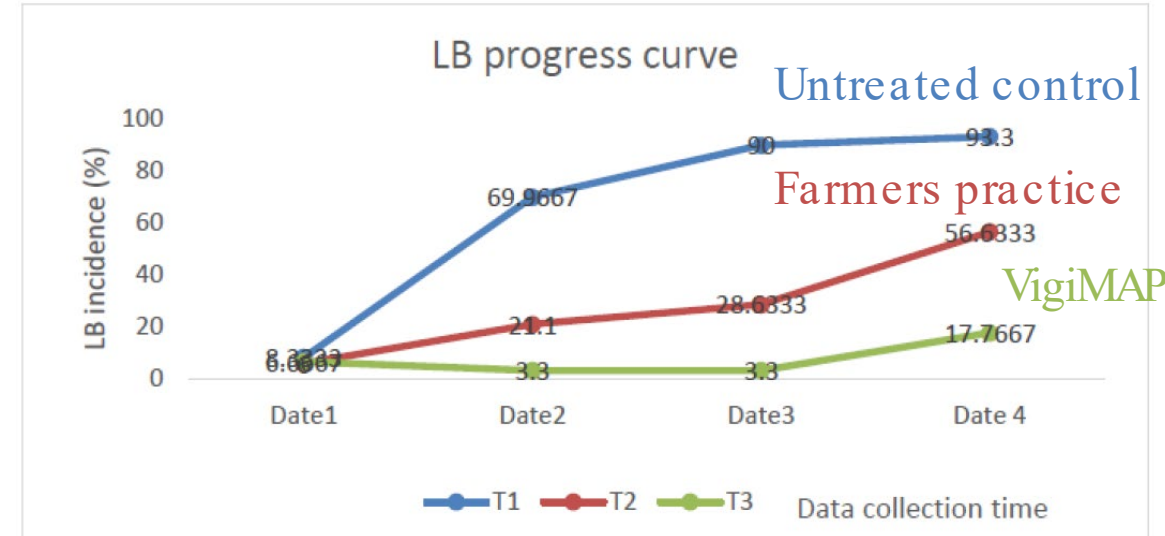
University college   Farmers cooperative

Guinea - Conakry

Fouta Djallon region :

- Temperature and humidity extremely favorable to PLB
- The model recommends spraying every 5 days (mancozeb is the only active ingredient commonly available)
- Farmers need to switch to less sensitive varieties and translaminar fungicides
- The model will be tested during interseason
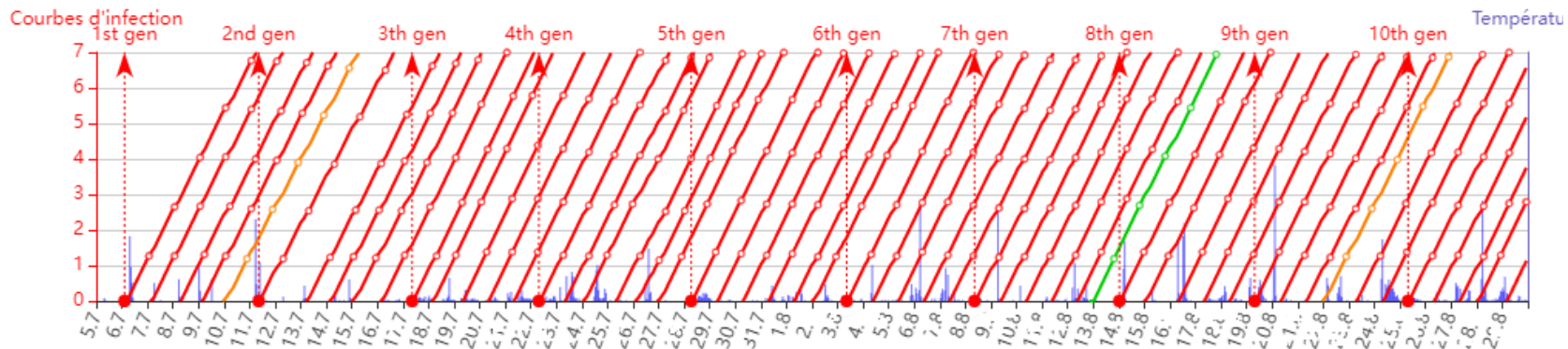
Training is the keystone

Thank you