

Azioni integrate ed innovative per la gestione delle micotossine: il progetto MycoKey, un esempio efficace di dialogo **UE-Cina**



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✘ Grant Agreement n. 678781

- ✘ Horizon 2020 programme, Societal challenge 2 "*Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy challenge*" - topic "Biological contamination of crops and the food chain".

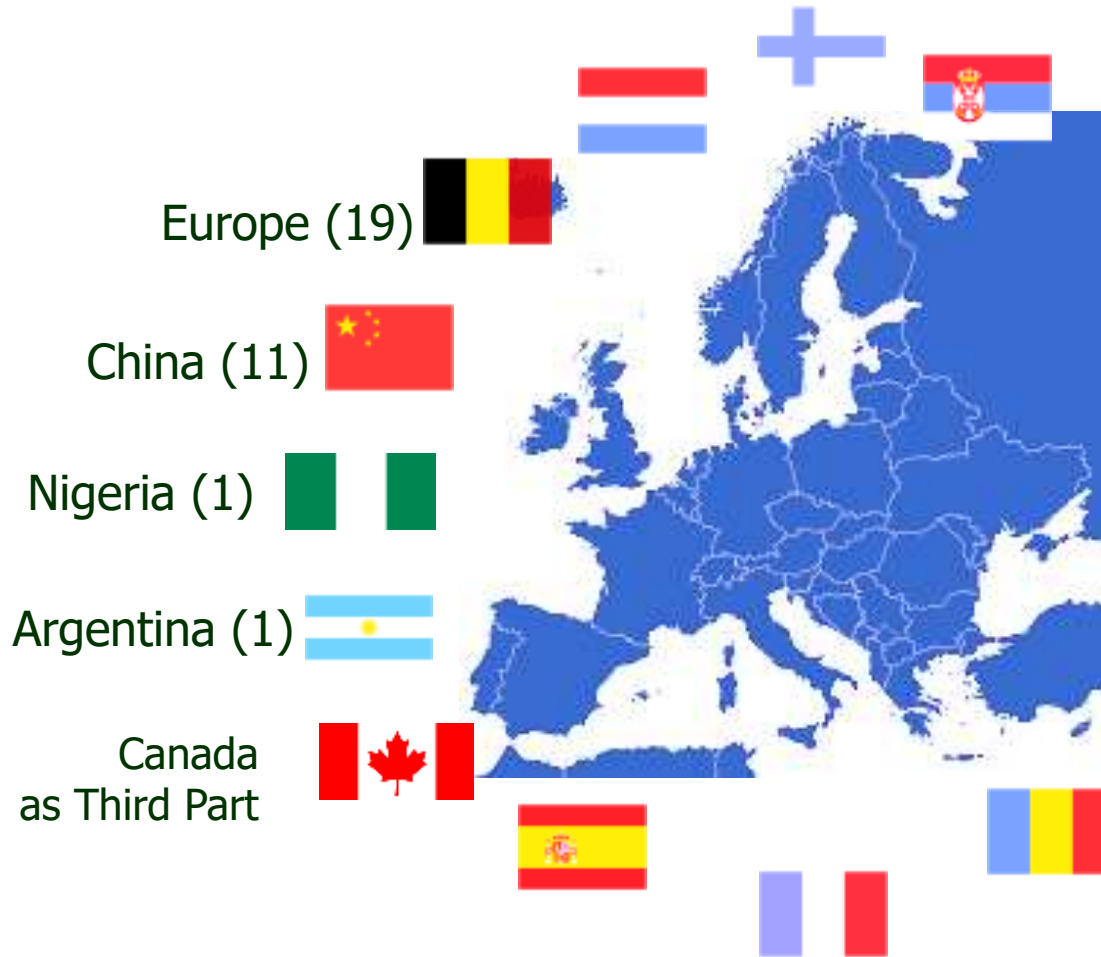
✘ Total value: 6,431 M Euro

✘ European Commission funding: 5M Euro

✘ China MOST Funding : about 540 K Euro

✘ Starting date: April 1, 2016

✘ Final date: March 31, 2020



**EU-CHINA
research
cooperation**



23 Scientific Partners
5 Industrial Partners
1 Producers Association
3 Small Medium Enterprises



EU-CHINA FOOD, AGRICULTURE AND BIOTECHNOLOGY (FAB) FLAGSHIP INITIATIVE



**A COMPREHENSIVE RESEARCH AND
INNOVATION COOPERATION PROGRAMME TO
TACKLE SUSTAINABLE AGRICULTURE, FOOD
SECURITY AND SAFETY IN THE EU AND CHINA**

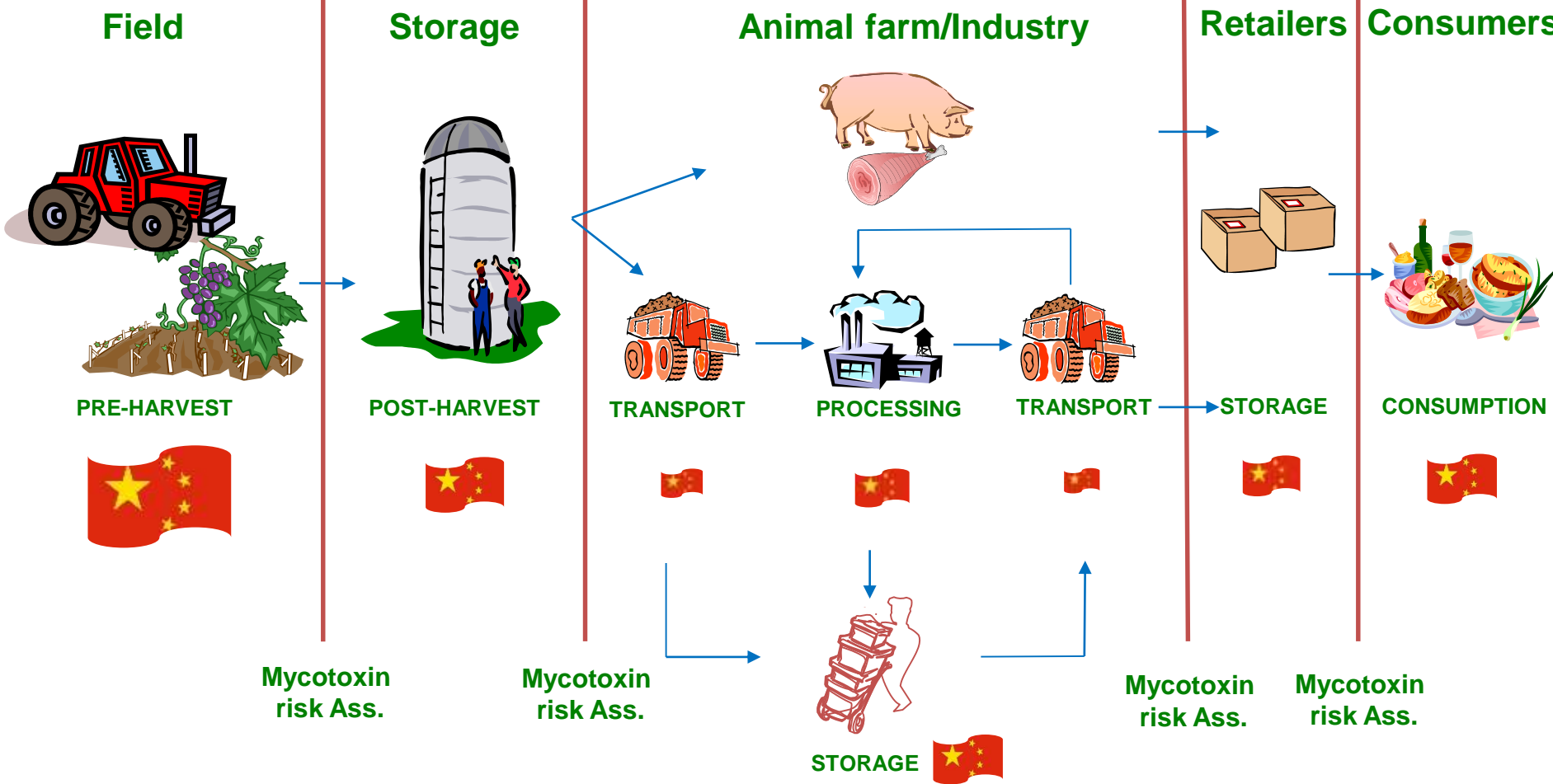
Priority Areas of mutual interest for EU China research and innovation



Interactions



Communication, Dissemination, Exploitation 



ICT SOLUTION for CHAIN MANAGEMENT





Maize

AFLA, DON, ZEA, FUM

Wheat

DON, ZEA, OTA, T-2, HT-2

Barley

DON, ZEA, OTA, T-2, HT-2

Grapes

OTA



Dried fruits

AFLA



PRE-HARVEST

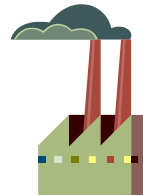
POST-HARVEST



FIELD



STORAGE



PROCESSING



DISTRIBUTION



CONSUMPTION

WP2 - Toxigenic fungi monitoring

WP3 - Mycotoxin monitoring

WP4 - Prevention

WP5 - Intervention strategies

WP6 - Remediation

WP7 - ICT-Solution for chain management

WP8 - Communication,
Dissemination & Exploitation

PRE-HARVEST

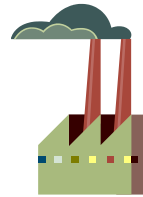
POST-HARVEST



FIELD



STORAGE



PROCESSING



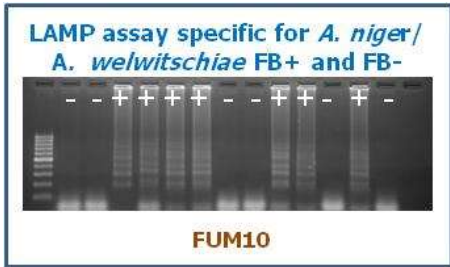
DISTRIBUTION



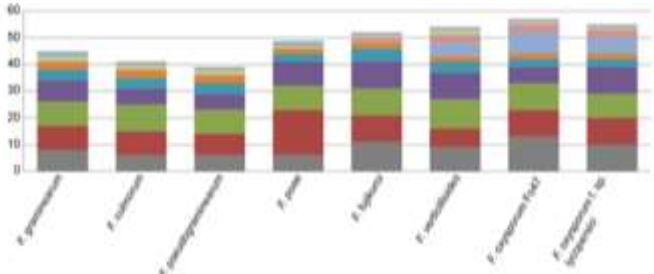
CONSUMPTION

WP2 - Toxigenic fungi monitoring

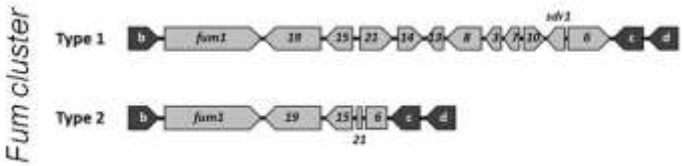
WP2 RESULTS



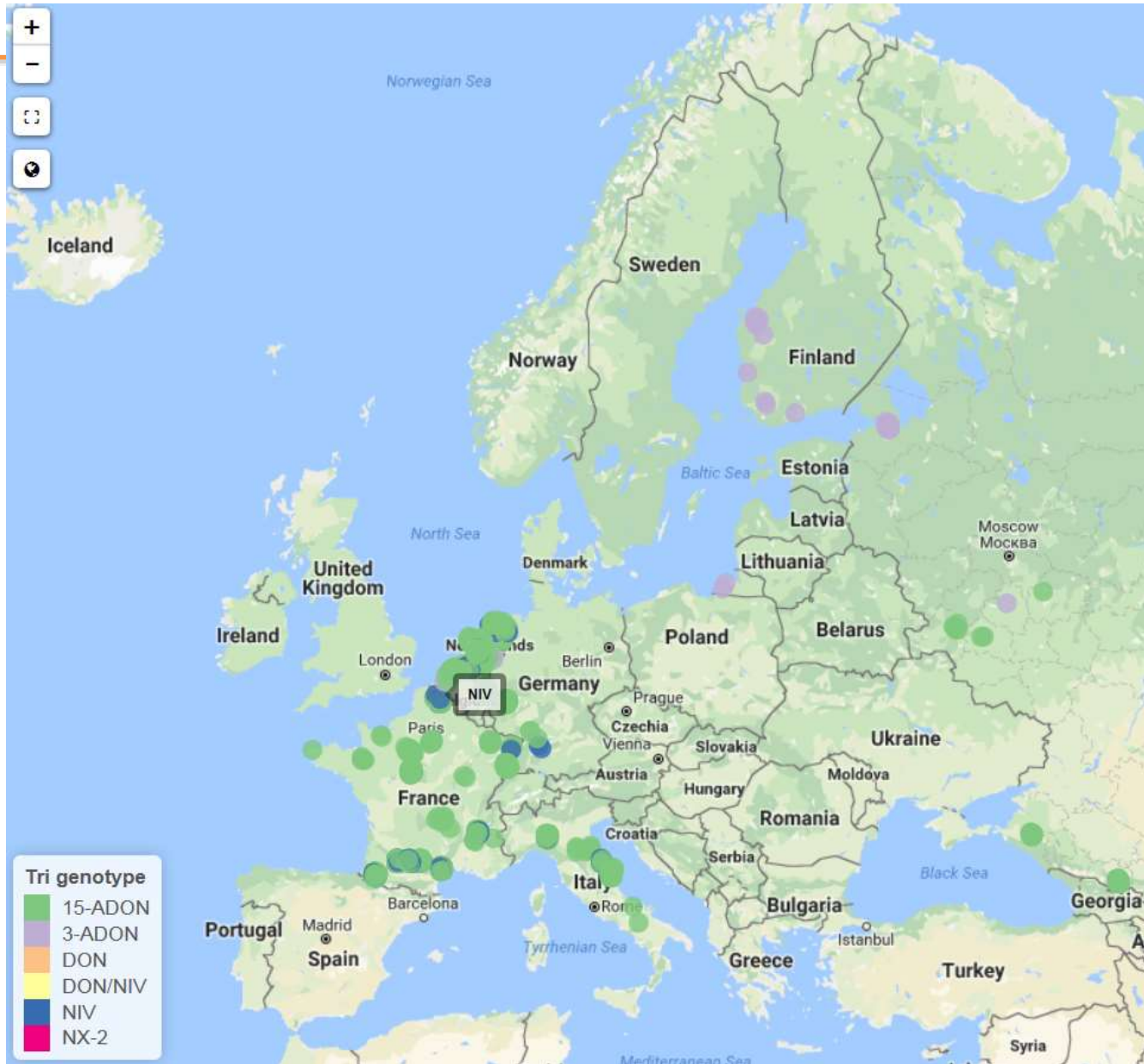
✓ Development of **LAMP assays** specific for FUM in *Aspergilli* and for Type A & Type B trichothecenes in *Fusarium* spp.



✓ Whole **genome sequencing** of 13 *Aspergillus* isolates and 40 *Fusarium* species and *Fusarium* species FHB geographical distribution



✓ Identification of **gene clusters** involved in specialized metabolism: *fum* and *ota* in *Aspergillus* species, *fum*, *enn* and *bea* in *Fusarium* species





FUNGI MONITORINGWP2 – TOXIGENIC :

Geographic risk maps

Global Fusarium database



Global Fusarium graminearum Database

Main dashboard | Map and chart | Full Table | About the database

Filters

The FGSC database is a curated database of peer-reviewed information of *F. graminearum* species complex (FGSC) members strains. Apply the filters to update the table, plot and map. Backspace within each field to clean up your search.

Last update: 2017-10-26

Clean filters

Select article(s)

Select Country

Year of isolation

Host

Species

Select genotype(s)

Geographic map

Trichothecene genotype by species frequency plot

Code	Host	Country	Year	Lat	Long	FGSC2	Tri genotype	Publ
0771001	Wheat	Brazil	2007	-28.0492	-53.2032	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771002	Wheat	Brazil	2007	-28.1082	-53.3544	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771003	Wheat	Brazil	2007	-27.9501	-53.2861	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771004	Wheat	Brazil	2007	-28.062	-53.3274	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771005	Wheat	Brazil	2007	-27.9541	-53.3772	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771006	Wheat	Brazil	2007	-28.1022	-53.3379	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771007	Wheat	Brazil	2007	-28.0338	-53.3537	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771008	Wheat	Brazil	2007	-28.0385	-53.4044	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771009	Wheat	Brazil	2007	-27.9963	-53.4176	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)
0771010	Wheat	Brazil	2007	-27.9889	-53.3098	<i>F. graminearum</i>	15-ADON	Astolfi et al. (2012)

Showing 1 to 50 of 10,560 entries

Previous 1 2 3 4 5 ... 218 Next

Legend for Trichothecene genotype by species frequency plot:

- 15-ADON
- 3-ADON
- DON
- DON/NV
- NV
- NS-2



PRE-HARVEST

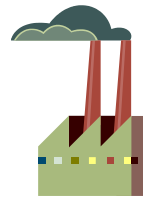
POST-HARVEST



FIELD



STORAGE



PROCESSING



DISTRIBUTION



CONSUMPTION

WP3 - Mycotoxin monitoring

WP3 RESULTS



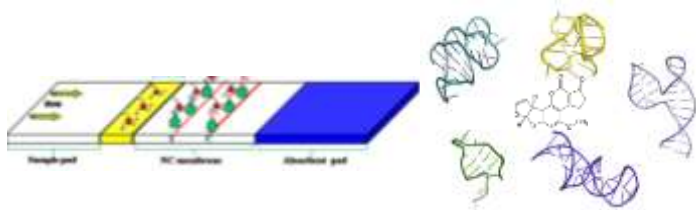
✓ Development of a LC-MS/MS multi-mycotoxin method for contamination in **dust** and **medical herbs**



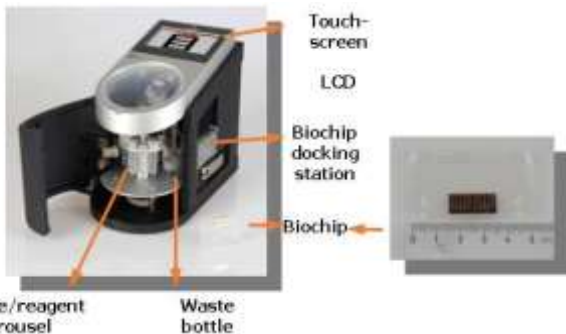
✓ The "3 Myco" **multiplex dipstick** test prototype for rapid detection of DON/ZEA/FUM was developed



✓ Prototype **aptamer based** multiplex strip test for the determination of **aflatoxins** and **fumonisin** in maize



✓ Development of assays for AFB₁ and OTA analysis in wheat and dried fig by using a **new biosensor platform** and **biochips** (Electrochemical biosensor)



✓ Selection of **antibody-tracer** combinations



PRE-HARVEST

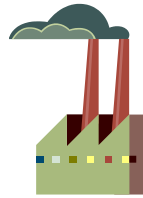
POST-HARVEST



FIELD



STORAGE



PROCESSING



DISTRIBUTION



CONSUMPTION

WP4 - Prevention

WP4 – PREVENTION IN THE FIELD



Biocontrol of *Aspergillus flavus* to prevent aflatoxin contamination in maize

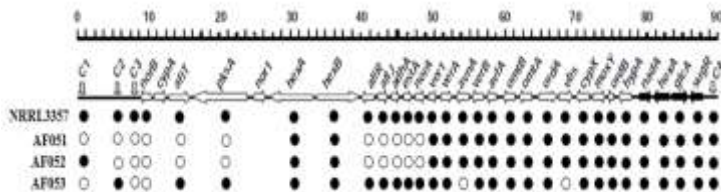


✓ **AFLA-AFRICA**
 Aflatoxin reduction from **98%** to **100%** in maize treated with Aflasafe GH01 in **Ghana**

✓ **AFLA-CHINA**
 Optimisation of fermentation conditions and formulation for the production of the atoxigenic strain ***A. flavus* AF051**



AFLA-EU
 Identification of 7 *A. flavus* strains (among 600 strains) lacking all genes of the aflatoxin cluster from **Romania** and **Serbia**, as BCA candidates



WP4 RESULTS

Breeding & BCA

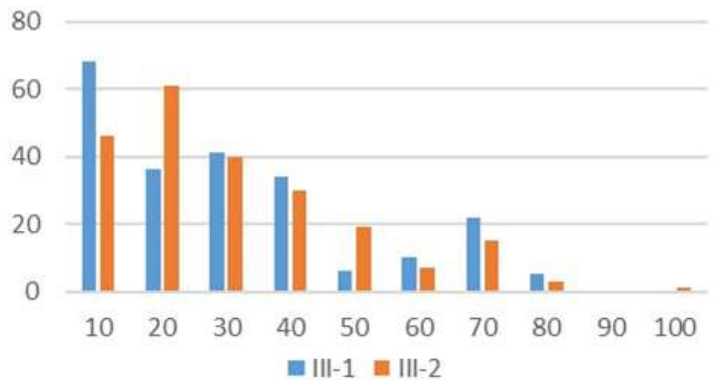


✓ Identified 49 **maize** lines resistant to Fusarium Ear Rot (33 lines highly resistant to *F. verticillioides*, 11 lines to *F. graminearum* and 5 to both species) and molecular markers (8 QTL and 3 genes) linked to resistance, in Italy

✓ Identification of agronomic interventions and biocontrol agents in cereals residues against **FHB (70-96%)**



✓ Selected 2 durum **wheat** lines (SY 516090 and SY 516006) FHB tolerant, in Italy



Deoxynivalenol content (ppm) as type III resistance

✓ Identified 6 loci associated with type II (percentage of infected spikes) and 6 loci associated with type III (deoxynivalenol content) resistance in **wheat**, in China



PRE-HARVEST

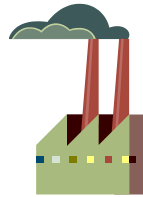
POST-HARVEST



FIELD



STORAGE



PROCESSING



DISTRIBUTION



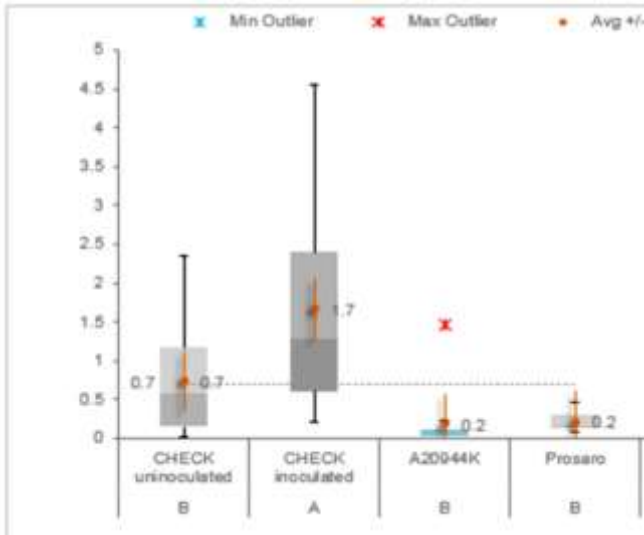
CONSUMPTION

WP5 - Intervention strategies

WP5 RESULTS

Fungicide and biocontrol agents application for *Fusarium* head blight control

FHB index: (incidence x severity /100)



✓ **88%** reduction of **FHB symptoms** after treatment with the Syngenta novel compound at flowering, in Italy

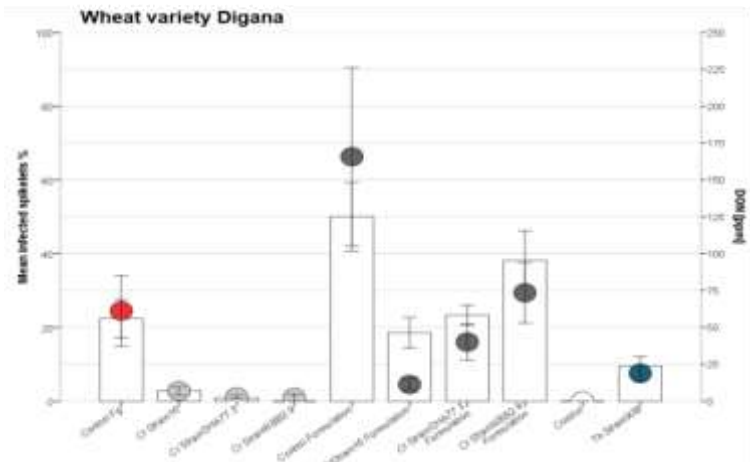
✓ **87%** of **DON** reduction with Phenamacril fungicide, in China



✓ Reduction of disease severity and DON content up to **100%** by *Clonostachys rosea* suspensions application

✓ Reduction of FHB infection and DON content of **50%** by *Trichoderma atrobrunneum* ITEM 908 application

✓ *Bacillus velezensis* RC218 and *Streptomyces* sp. RC 87B inoculation on durum wheat heads: reduction of **50%** of DON



PRE-HARVEST

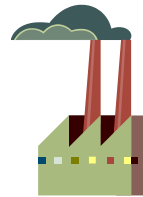
POST-HARVEST



FIELD



STORAGE



PROCESSING



DISTRIBUTION



CONSUMPTION

WP6 - Remediation



✓ Industrial-scale cleaning equipment for mycotoxin reduction

1. Grain Plus™
(size separator + aspirator)



2. Concentrator MTCB™
(density separator)



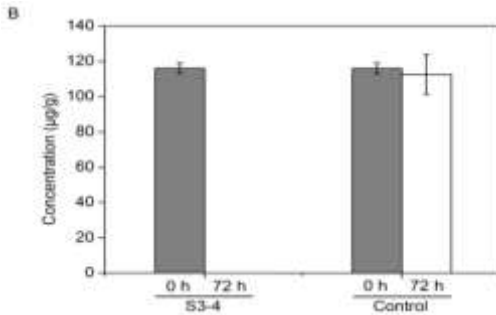
3. SORTEX® A (optical sorting)



The combination of mechanical and optical cleaning technologies at industrial-scale level (3-17 tons) allowed:

- a total **aflatoxins reduction of 60-90%** in maize
- an overall **reduction of *Fusarium* toxins** in maize of **up to 55% for DON, up to 100% for ZEA, and up to 65% for FBs**

WP6 RESULTS

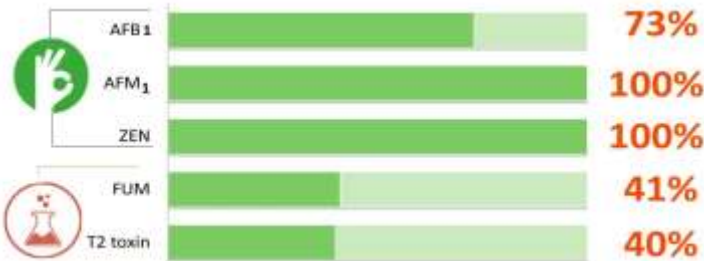


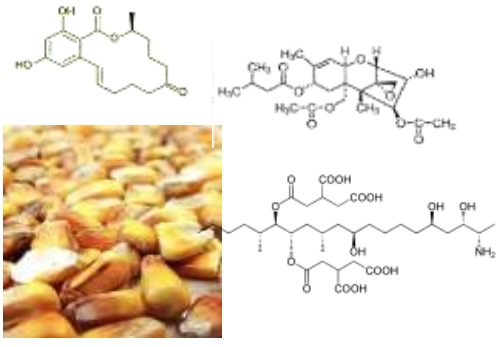
✓ **OTA** reduction from **41** to **62%** during wine processing by a strain of the yeast *Metschnikowia pulcherrima* and three strains of *Lactobacillus plantarum*

✓ **DON** degradation of **100%** in wheat grains contaminated with DON by the bacterial strain S3-4 isolated from soil

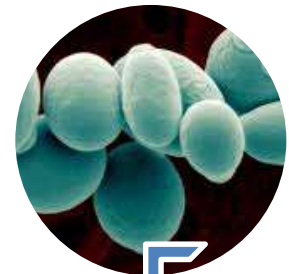
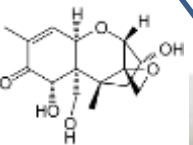
✓ **AFB₁** degradation of **80-100%** by mushroom (e.g. *Pleurotus eryngii*)

✓ Mycotoxin degradation by laccase: **100%** of **AFM₁** and **ZEN**, **73%** of **AFB₁**, **40%** of **FUM** and **T-2 toxin**



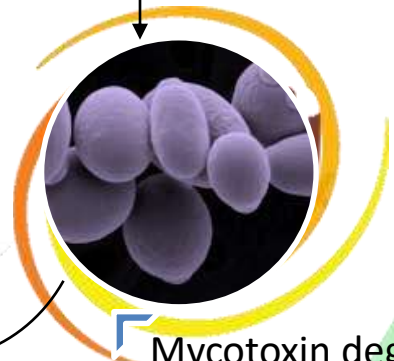
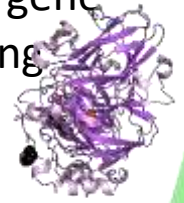


Contaminated batches



Distillers' yeasts

Laccase gene cloning



Mycotoxin degrading distiller's yeasts



DGGS used as feed ingredient and fertilizer

WP6 RESULTS

In vitro and *in vivo* assessment of the multi-mycotoxin adsorption efficacy of **FEED ADDITIVES**

Additive	Assay	Mycotoxin reductions (%)			
		AFB ₁	ZEA	OTA	FB ₁
YCW based product	<i>In vitro</i>	Little	86	65	66
	Rats	None	75	49	42
	Pigs	None	59	None	73
Bio-organoclay	<i>In vitro</i>	99	99	85	82
	Rats	94	65	54	40
	Pigs	88	44	39	32



IN VITRO

IN VIVO



PRE-HARVEST

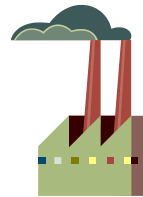
POST-HARVEST



FIELD



STORAGE



PROCESSING



DISTRIBUTION



CONSUMPTION

WP7 - ICT-Solution for chain management

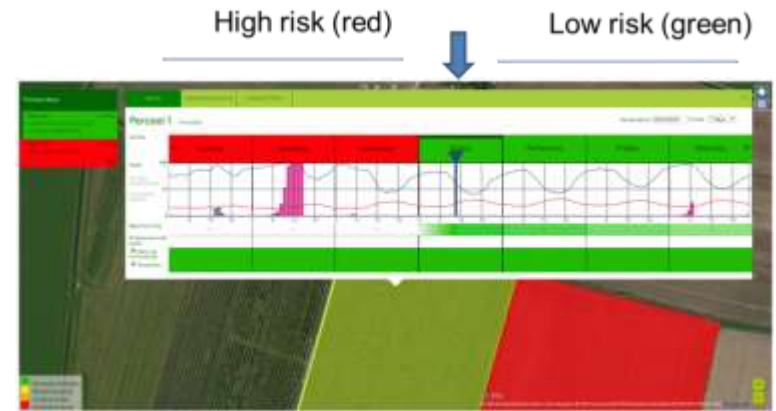
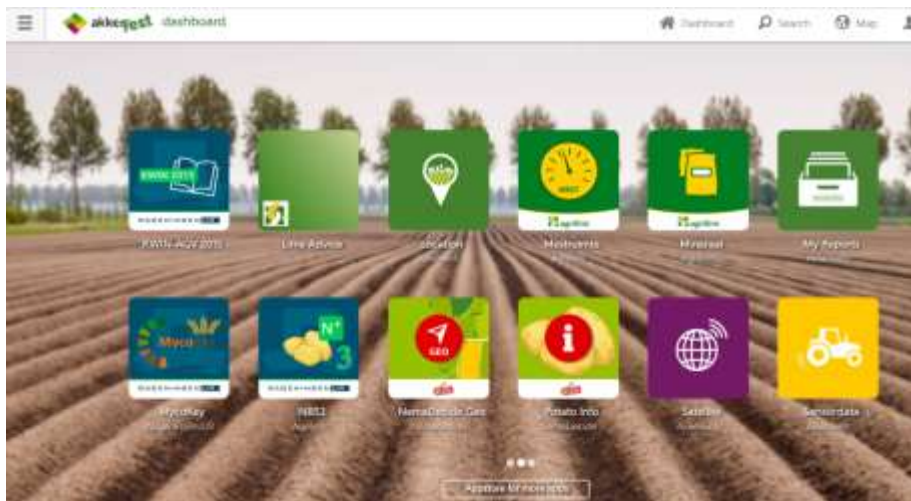
WP7 RESULTS



✓ Generation of the **MycoKey App**

to generate a direct and effective dialogue between researchers and growers

to assist different stakeholders to mitigate the **mycotoxin risks** along the agro-foodchain



MycoKey APP



- 1: **Disease**
- 2: Insect damage
- 3: **Weeds**
- 4: **Nest**
- 5: **Sample** [soil, leaf, etc.]
- 6: **Stunted growth**
- 7: **Hotspot**
- 8: **Deficiency**
- 9: Obstacle [rock]



MycoKey APP

MycoKey

Thomas Hans B 69.69 ha


Mais 1 Korrelmais	3.27 ha
Naast Leeuwarden Wintertarwe	5.55 ha
Perceel 1 Wintertarwe, Diervoeder Accent	16.14 ha
Perceel 2 Wintertarwe	13.49 ha
Perceel 3 Wintertarwe	6.71 ha
Perceel 4 Wintertarwe	13.63 ha
Perceel 5 Wintertarwe	3.74 ha
Perceel 7 Wintertarwe	2.82 ha
Perceel 8 Wintertarwe	4.34 ha

Thomas Hans Been 34.15 ha

Stoekveld

Compare DON Credits

Food / Naast Leeuwarden



Food Feed

Variety
Accent

Previous crop
Aalbes

Expected levels of mycotoxins are color in field and gauge

Drone acquired by WUR

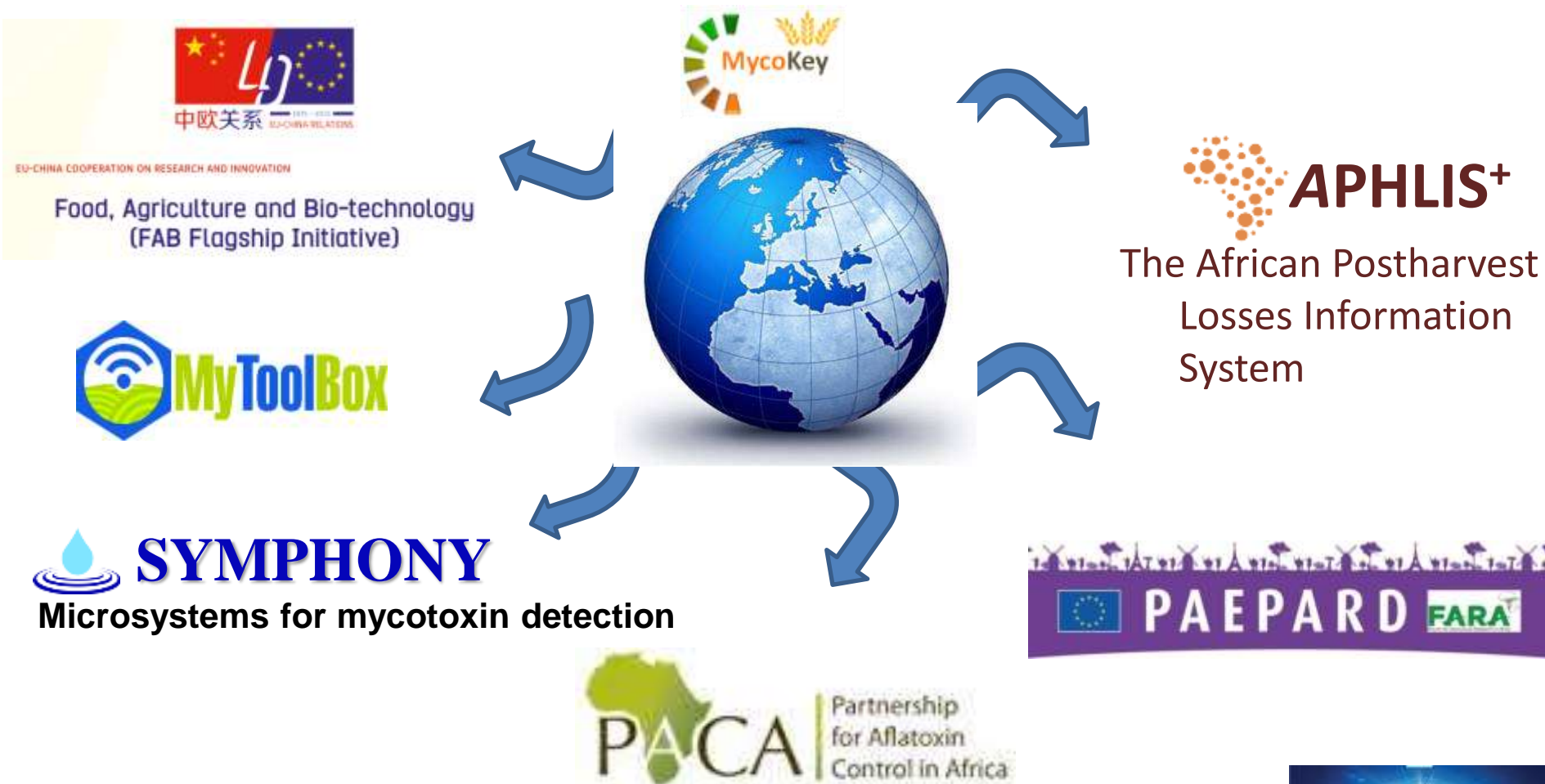


GPS: 52.2467021/5,8218081

Autonomous flight with current routing apps ≥ 20 meter
DJI X4S camera (GDS = 0.43 cm at 20 m)



MycoKey will favour opportunities to strengthen existing communities thus contributing to improve effective international cooperation









3°  **Conference**
Bari
10-12 Marzo, 2020





**Thanks for your
attention!**

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