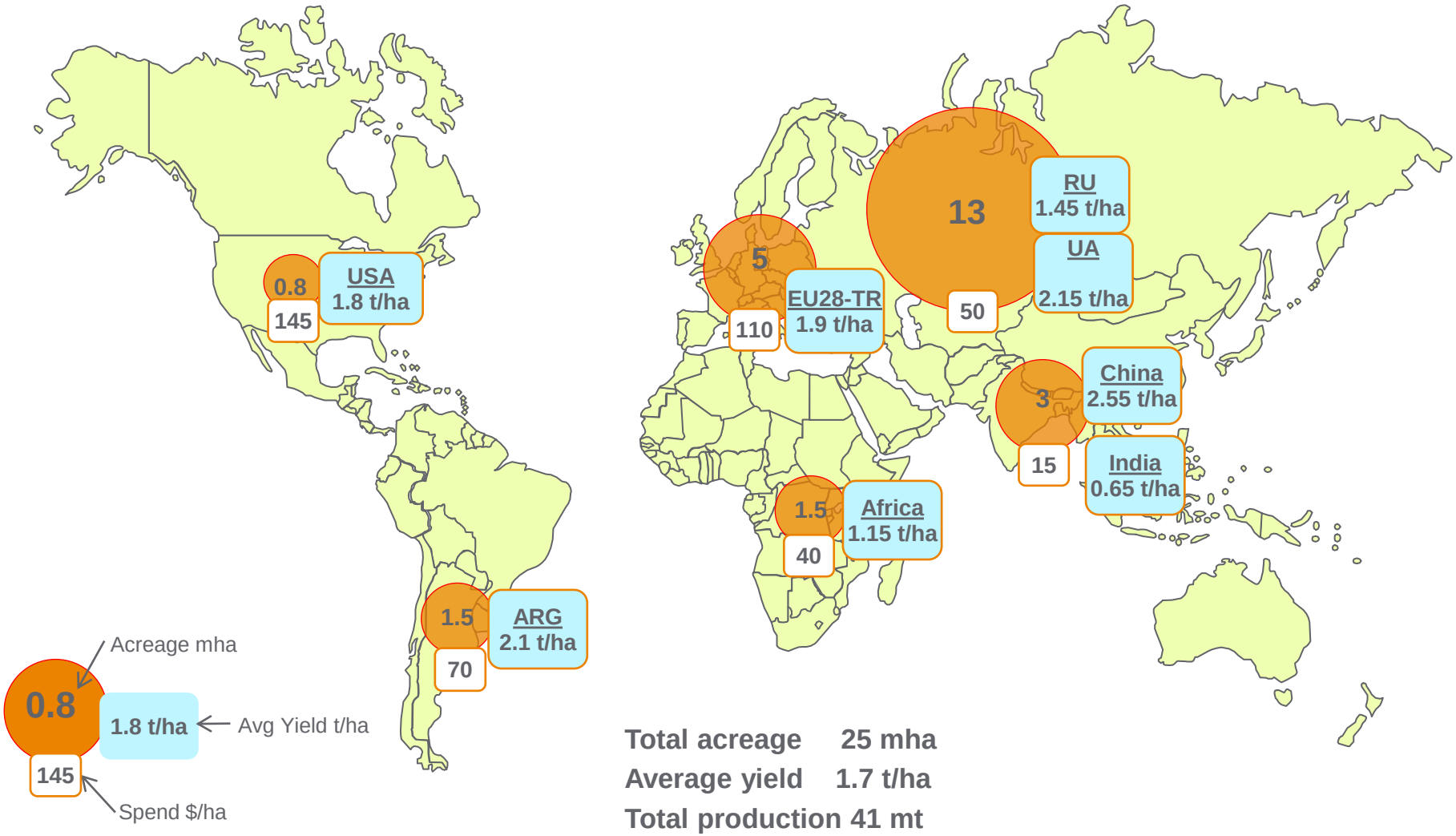
Traits that provide solutions beneficial throughout the value chain

Sunflower : How to control Broomrape a devastating weed ?

Amsterdam, April 3rd 2017

Sunflower is a global crop with strong European focus

2015 Sunflower global economy and grower spend per hectare*



Total acreage 25 mha
Average yield 1.7 t/ha
Total production 41 mt

* Spend per hectare includes total spend on seed, crop protection and seed treatment
Source: USDA, Informa Economics, European Commission, Syngenta analysis, Oilworld

From the consumer to the grower

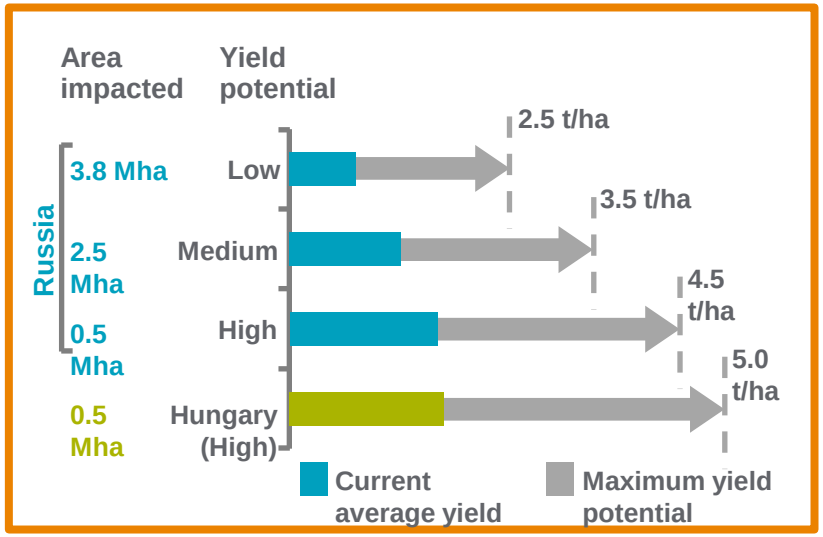
Consumer and value chain

- The consumer favors oils such as sunflower because of:
  - Health
  - Traceability
  - Environment

How can the consumer and the value chain be secured about the supply of sunflower oil ?

Grower

- Drive sustainable farm productivity
- Step change in farm profitability
- Ensure crop sustainability
- Limit Broomrape expansion in CIS
- Intensification via full integration of technologies (herbicide + trait) => beyond genomics



Drivers of Sunflower oil demand

1. Health

- Health concerns and nutritional recommendations
- Reduce risk of cardiovascular diseases (by limiting *trans fat* and saturated intake)

2. Regulatory Environment

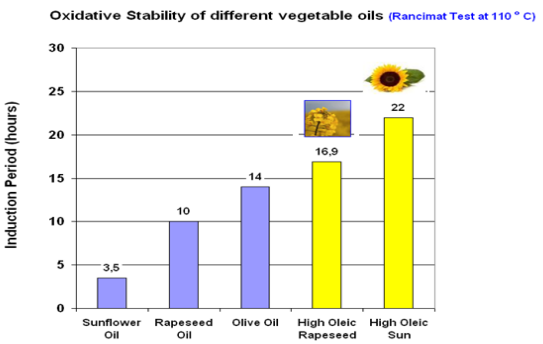
- New (EU 1169/2011) labelling regulation after 2014 for oil blends and food ingredients
- Labelling and bans of *trans* fatty acids in several countries
- EFSA recommendation to set mandatory information on 3-MCPD and Glycidyl esters content in refined oils and foods.

3. Oxidation resistance (in case of High Oleic Sunflower)

- HO oils longer shelf life than conventional oils
- Improved stability without hydrogenation (No *trans)*

4. Palm oil "media bashing"

- Labour / Environment / Health issues



Source: Syngenta elaboration

Not all vegetables oils created equal – SF oil very healthy

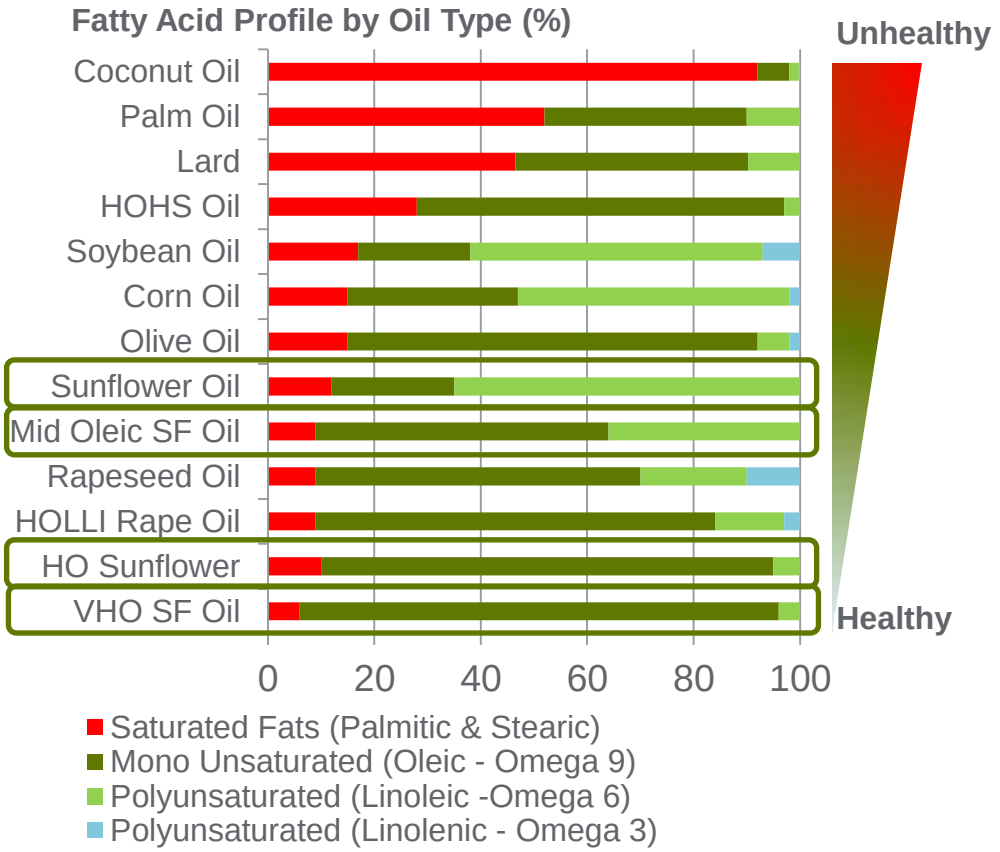
The Challenge:

Saturated fats = ↑cholesterol = ↑heart disease

- All vegetable oils are “fats” in liquid form at room temperature
- Vegetable oils contain different profiles of fatty acids
- Recent health concerns have lead to “recommendations” by different organizations on the “preferred” fatty acids
- This is because certain fatty acids (i.e., “saturated”) are associated with cholesterol causing cardio vascular diseases

The Solution:

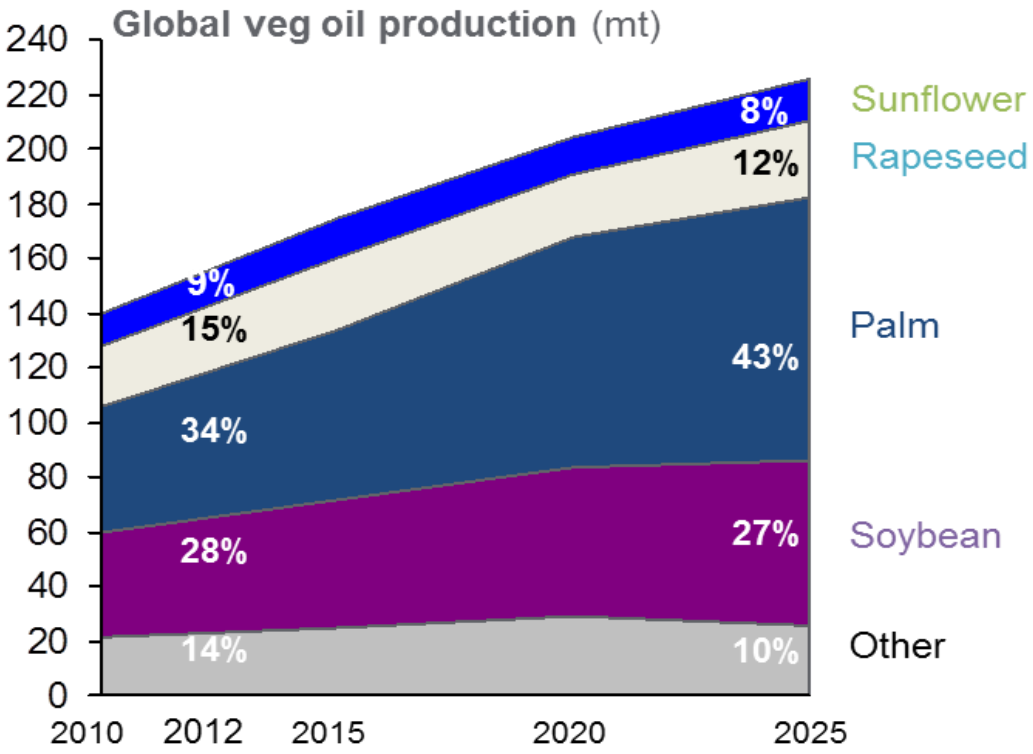
HO SF (Oleic) = ↓ cholesterol = ↓ heart disease



Source: ‘Oils & Fats in the Diet’ – British Nutrition Foundation 2009

Watch out threats from other oils

Increasing pressure from palm and soy



- Soybean acreage influenced by demand for meal, which produces soybean oil as byproduct
- Palms planted in 2007 will bring excess oil to market in ~2018
- Excess palm oil expected to reduce SF/OSR production in export markets (Ukraine & Canada)

Source: LMC report 2013

SF under pressure from palm & soy
Differentiation is a must to compete sustainably !

- Demand for veg oil growing faster than GDP/capita, converging on 25 kg/capita of veg oil per year
- Health concerns & new regulations in developed markets

Consumers & value chain

- Largely driven by Chinese demand for **feed**
- Soy oil a meal production co-product, not driven by oil demand

Soy meal

"The softseeds squeeze"

Palm oil

- Primary driver is emerging markets **food** demand
- Supply not affected by Year on Year demand
- Reflects investment decisions made 25 years before

Crude oil prices
Biofuel mandates

- Crude oil : main driver of oilseeds complex price volatility
- Biofuel mandates / biodiesel high price-elasticity

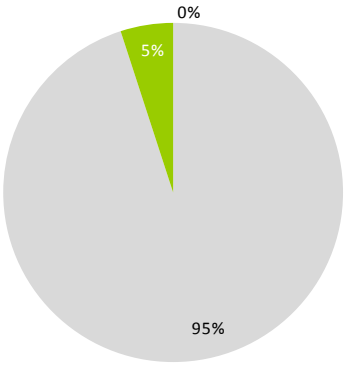
Intensify to be more competitive as a crop (CIS a must!)

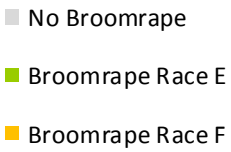
Become the source of "**healthy** vegetable oil" with **High Oleic SF**

Innovate to make the crop sustainable in the future

SITUATION ANALYSIS: BROOMRAPE RACES DEVELOPMENT 1994

Sunflower acreage





Broomrape Area Race E

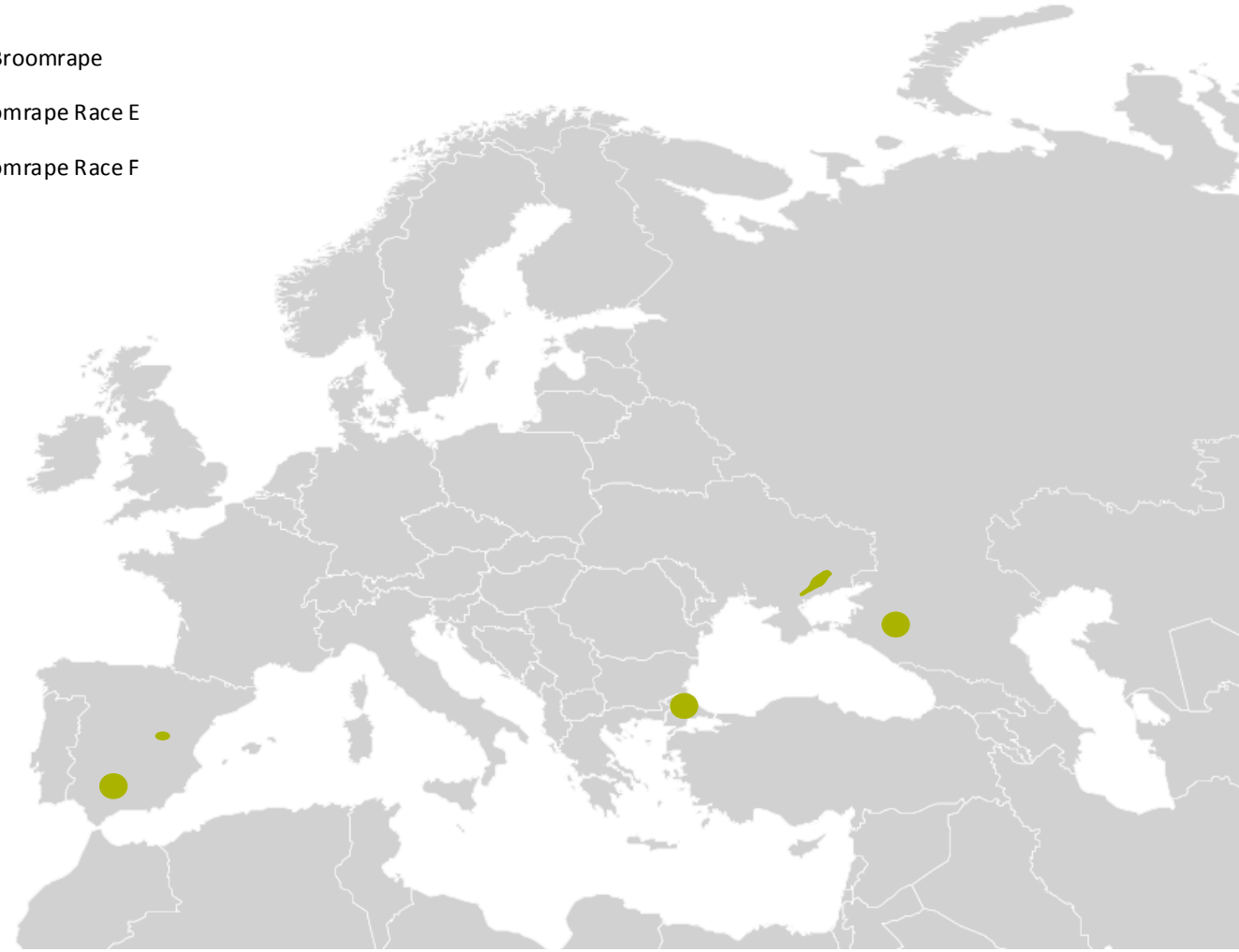
Acreage: **few ha**

Broomrape Area Race F

Acreage: **0 m²**

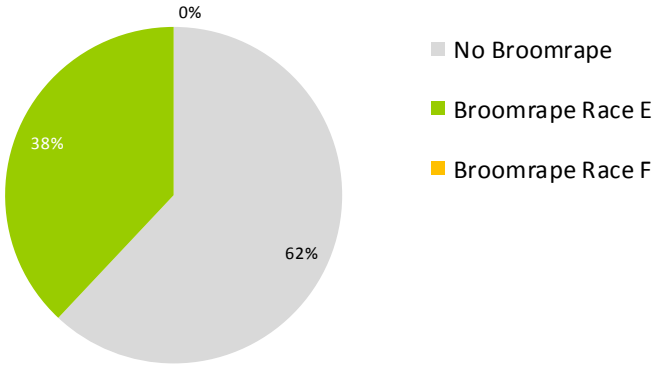
Broomrape Area Race X

Acreage: **0 m²**



SITUATION ANALYSIS: BROOMRAPE RACES DEVELOPMENT 2000

Sunflower acreage



Broomrape Area Race E

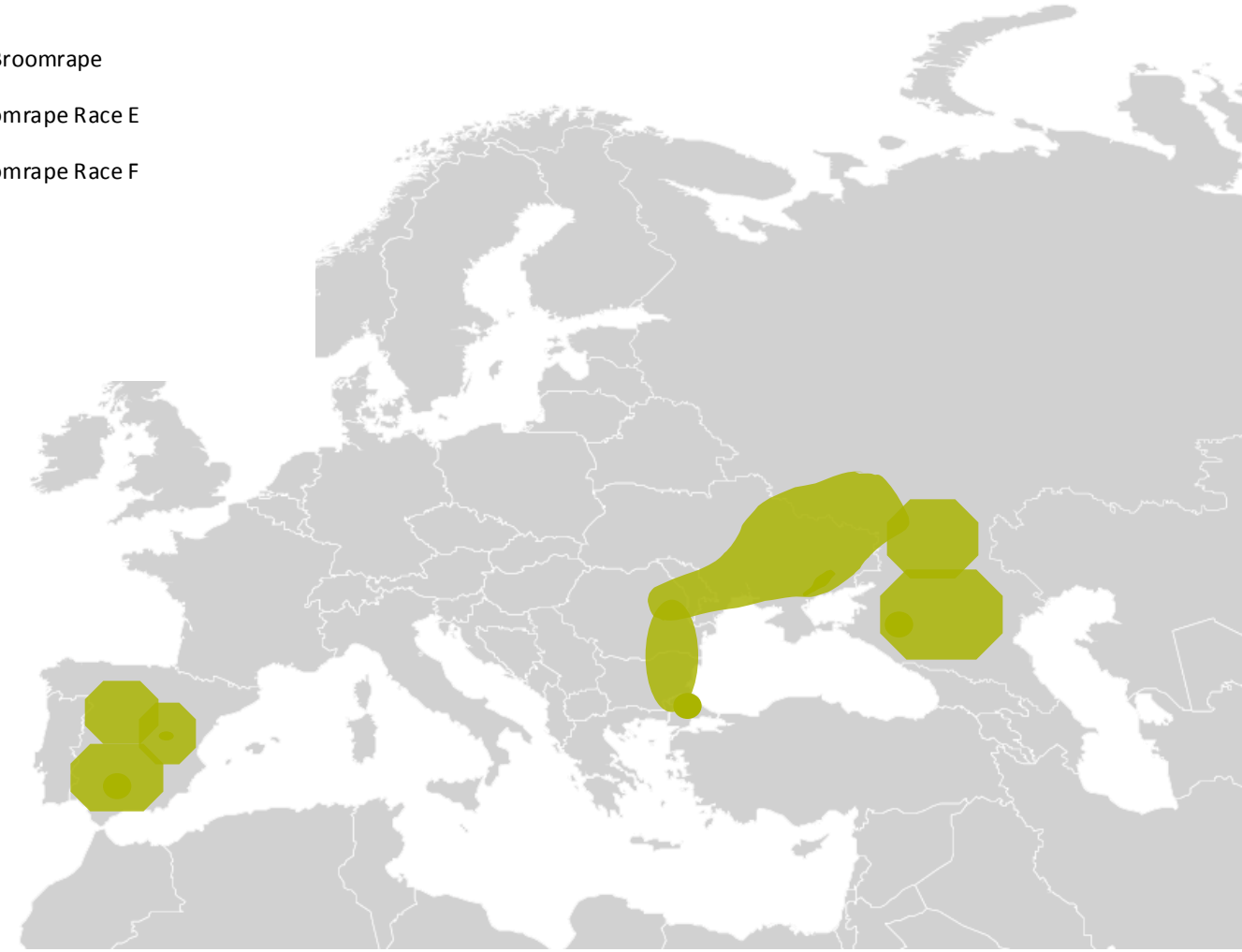
Acreage: **10 m ha**

Broomrape Area Race F

Acreage: **few ha**

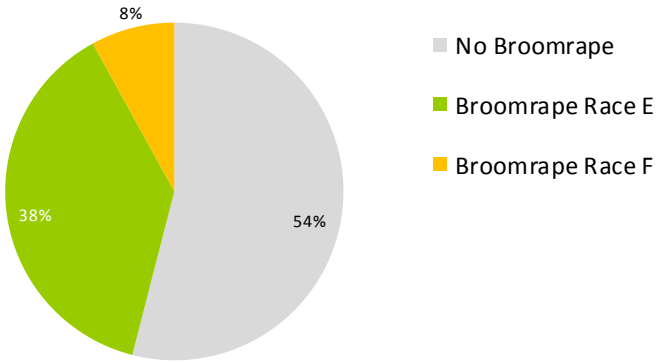
Broomrape Area Race X

Acreage: **0 m²**



SITUATION ANALYSIS: BROOMRAPE RACES DEVELOPMENT 2009

Sunflower acreage



Broomrape Area Race E

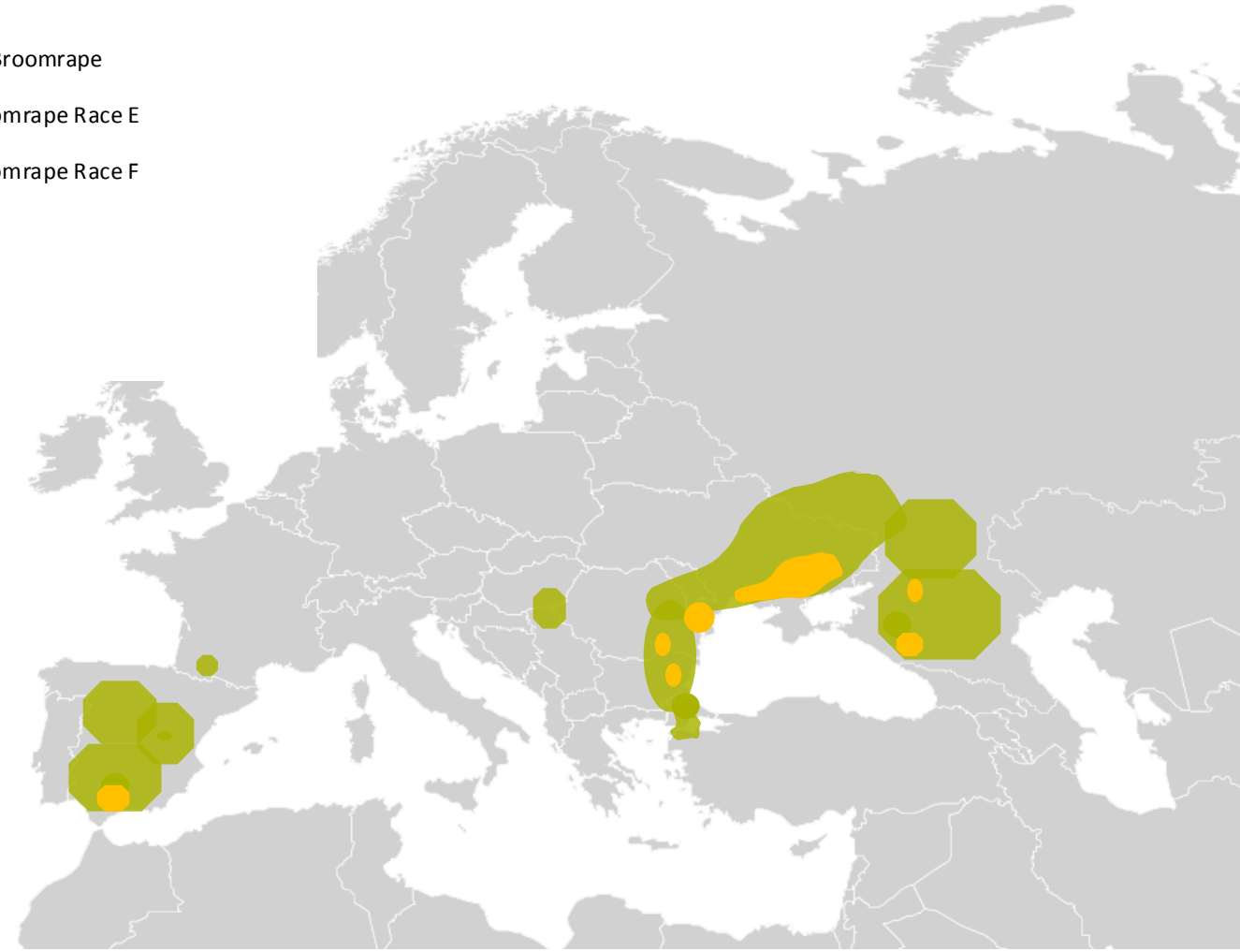
Acreage: **10 m ha**

Broomrape Area Race F

Acreage: **2 m ha**

Broomrape Area Race X

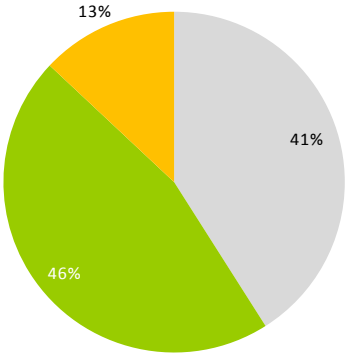
Acreage: **few m²**



SITUATION ANALYSIS: BROOMRAPE RACES DEVELOPMENT 2012

integrated solutions

Sunflower acreage



No Broomrape

Broomrape Race E

Broomrape Race F

Broomrape Area Race E

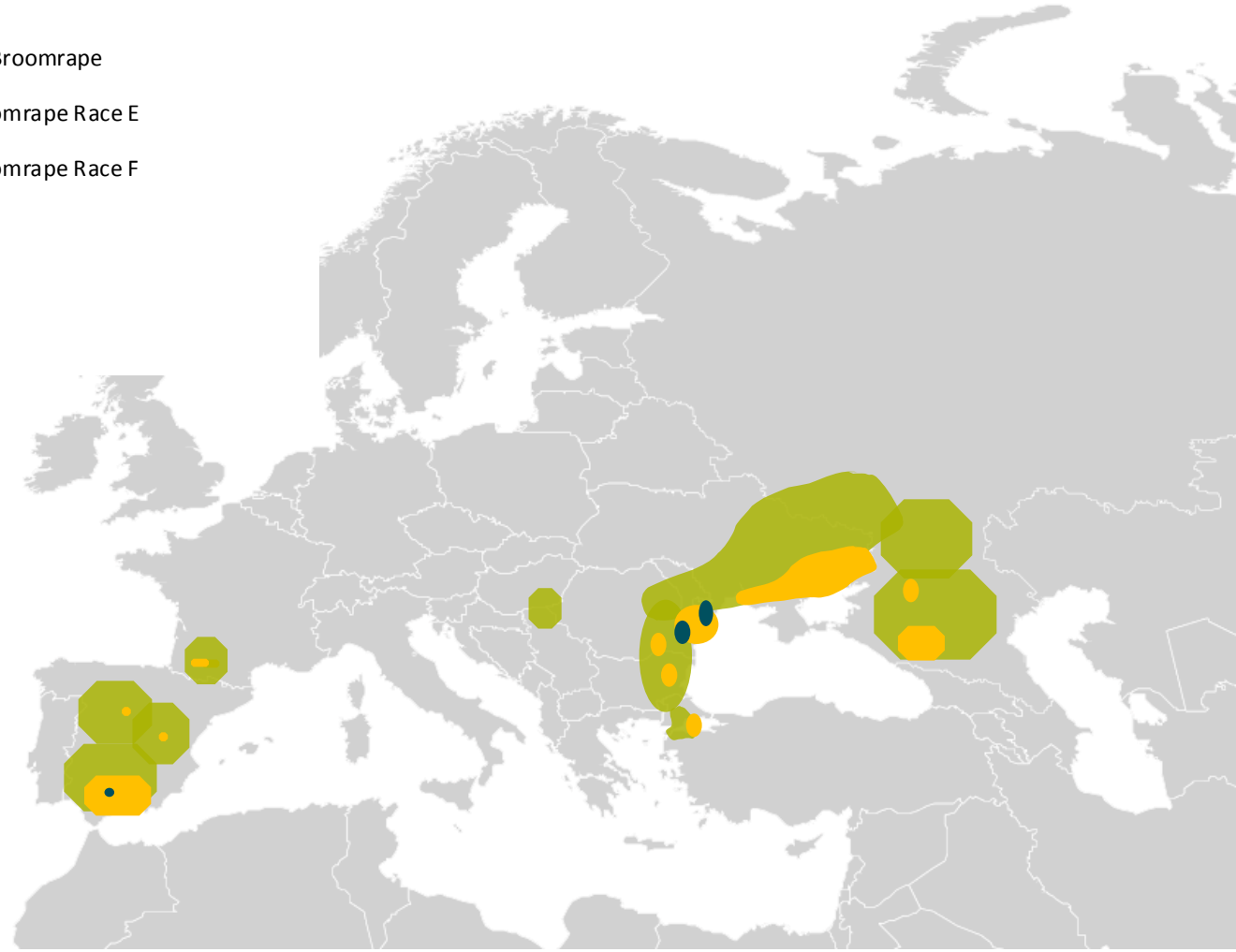
Acreage: **~ 12 m ha**

Broomrape Area Race F

Acreage: **~3,2 m ha**

Broomrape Area Race X

Acreage: **few ha**



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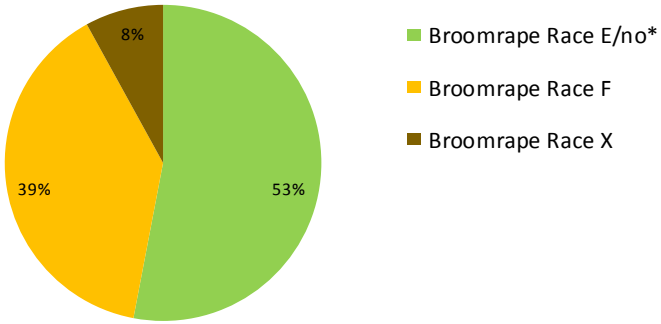
SITUATION ANALYSIS: BROOMRAPE RACES DEVELOPMENT 2016

BROOMRAPE IS AN EXPANDING THREAT FOR THE SUPPLY OF SUNFLOWER OIL

integrated solutions

Sunflower acreage



Broomrape Area Race E / no*

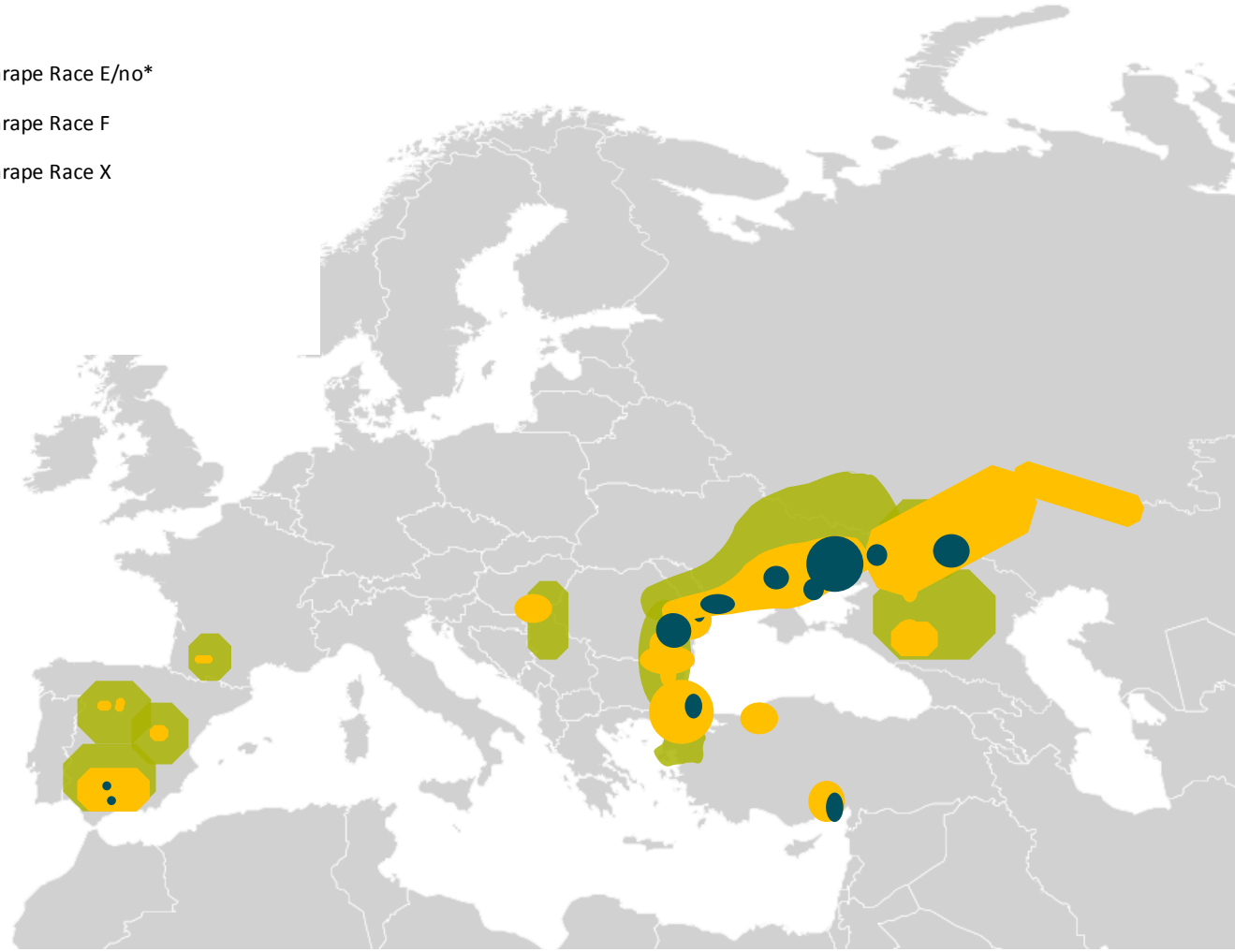
Acreage: **~9,5 m ha ***

Broomrape Area Race F

Acreage: **~7 m ha**

Broomrape Area Race X

Acreage: **~1,5 m ha**



* There are sunflower areas without broomrape in grey
9,5 m ha (53%) include areas with Br E and no broomrape

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Combined technologies for sustainable management of Broomrape

- Most important risk factor.
- Causes up to 100% yield loss
- Thousands seeds produced
- Potential new mutations every 4-5 year
- Spreads easily

- **Genetic Resistance**
  - Historical control method
  - New genetic resistances developed overtime to control emerging new Broomrape races
- **Chemical Control**
  - Imidazole chemistry provides broomrape control
  - For use within Clearfield® production system
- **Crop Management**
  - Reduction of crop rotation cycle increases speed of race evolution and spread
  - Prophylactic measures limit the spread of broomrape

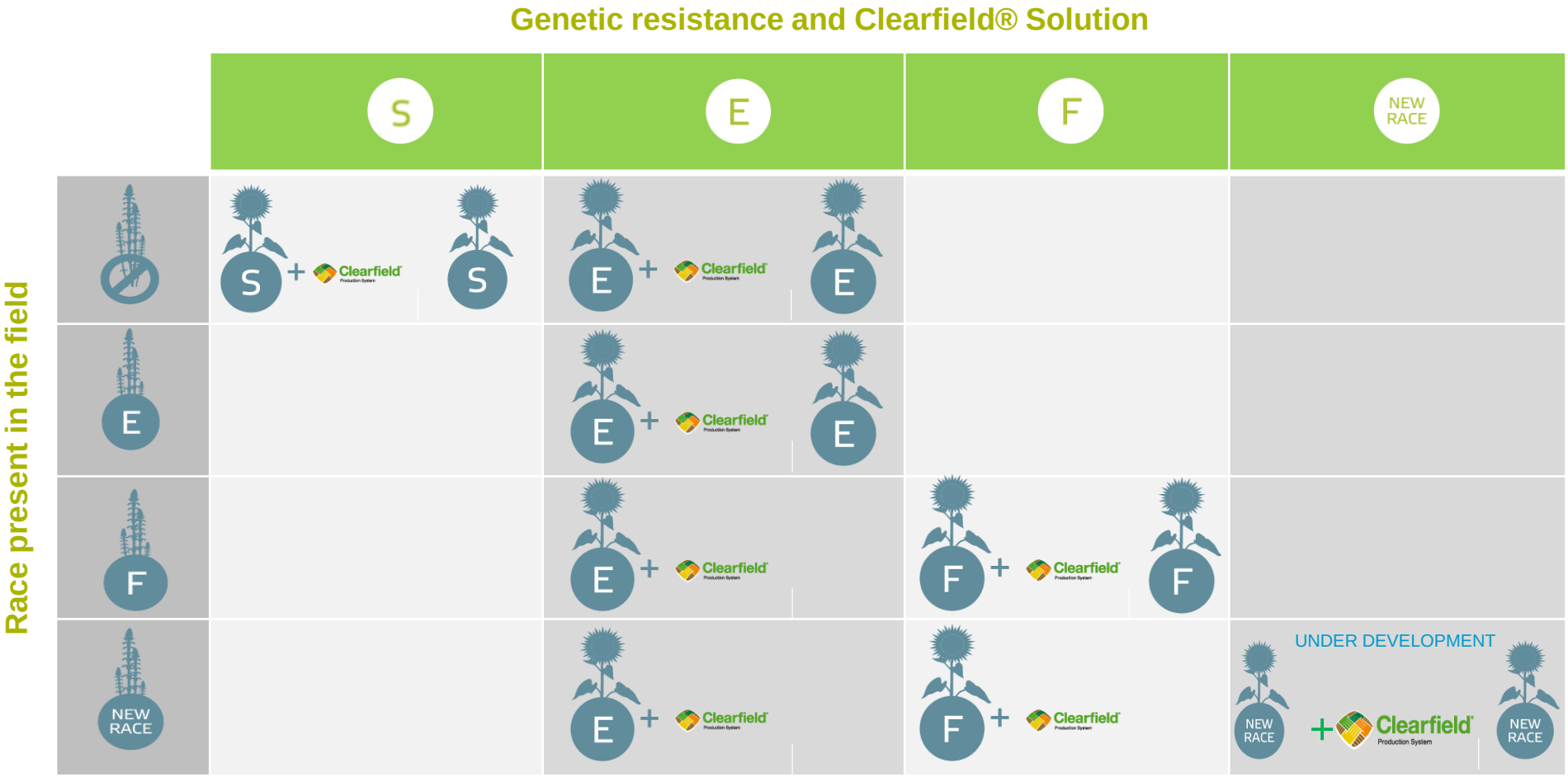
Combined technologies for sustainable management of Broomrape

Genetic resistance | **Chemical control** | **Good practices**

Benefits of an integrated strategy:

1. Prevent broomrape introduction into non infected fields
2. Avoid dispersion, evolution and reduce the seed stock in the soil of infested fields
3. Contribute to limit appearance of new resistance races of broomrape
4. Integrate weed management and broomrape control

Combination of technologies in practice



- Broomrape mutates into new races every 4-5 years and can by-pass genetic resistance
- Combination of Genetic resistance and chemical control delivers a sustainable management of the weed => less risks of by-pass

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Combined technologies for sustainable management of Broomrape

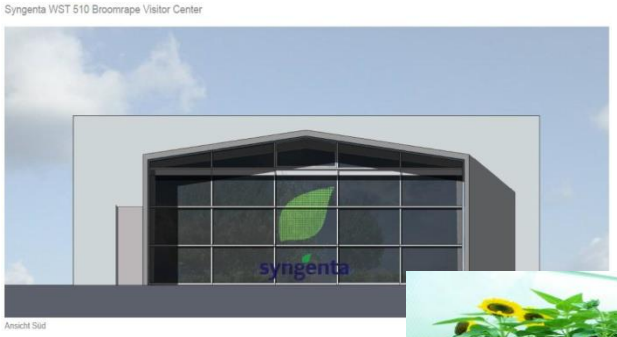
With 50% of Europe infested, broomrape is a major concern

- The parasitic plant attaches to roots and depletes the host of nutrients and water

- Spreads easily (50k seed/plant
- Can last up to 20 years in the soil
- New weed mutations every 4 to 5 years

- Up to 100% yield losses
- Controlled today with native traits and limited crop protection

Providing the solution



- Broomrape centre of excellence in Stein Switzerland is a major milestone towards establishing “total control”
- Multi-disciplinary research allows for an integrated, sustainable approach:
  - Native traits: resistance to latest races
  - Innovative active ingredients/seed care

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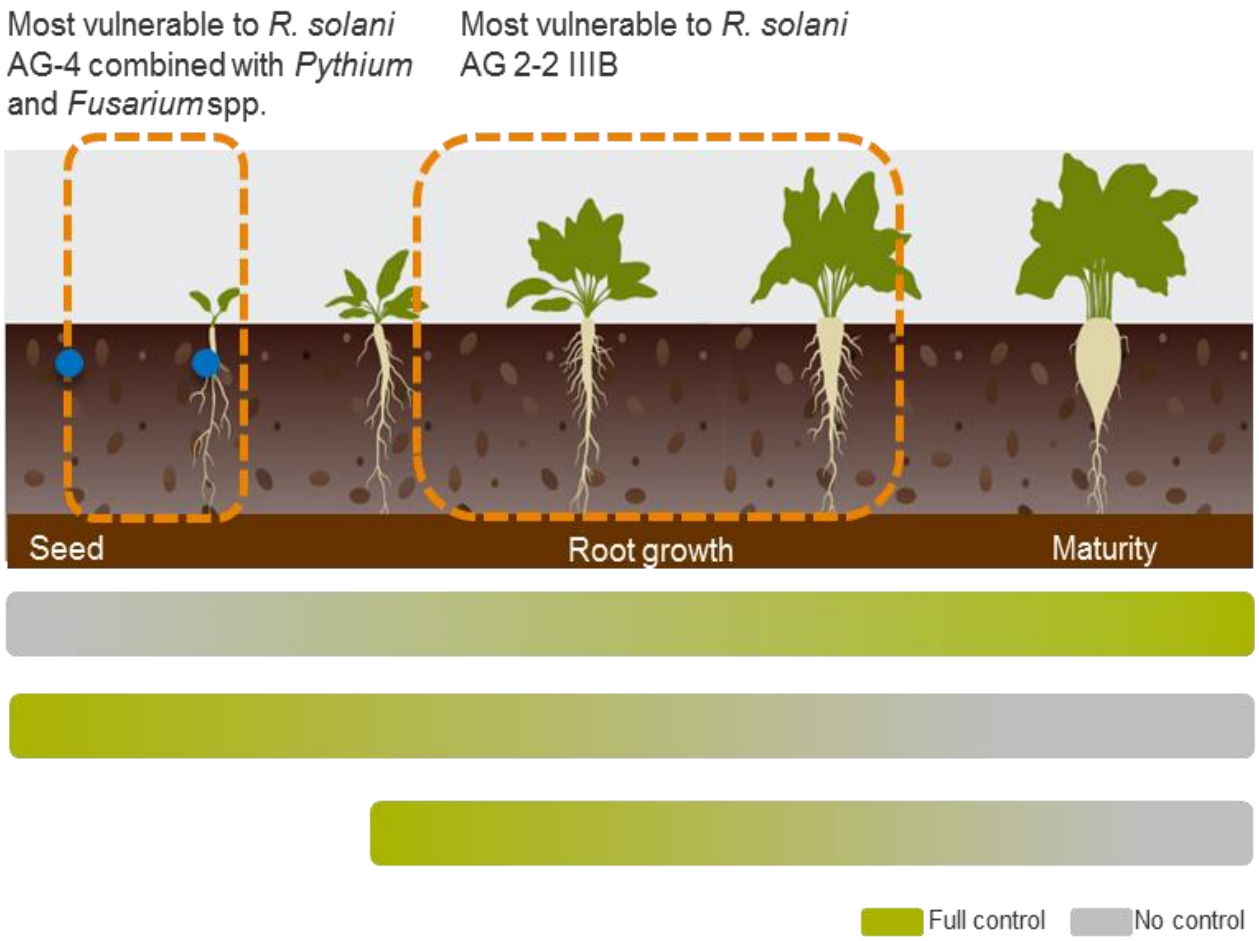
Examples of combination of technologies in other crops

Sugar beet: Syngenta solution controls Rhizoctonia infections at all critical growth stages

Syngenta is uniquely positioned to provide

- sustainable, full season control of all relevant *R. solani* anastomosis groups with its broad portfolio
- comprehensive technical expertise
- tailored offers based on risk modelling and market needs



* Expected European launch in 2017, US launch 2015

** PROVEN AMISTAR Technology includes Amistar, Quadris, AmistarXtra and a formulation under development

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Conclusions – Food for thought

- The sustainable management of pests / parasites secures the availability of goods for the supply chain.
- The combination of native traits and Herbicide Tolerance offers an interesting and long term solution for such sustainable management.
- Securing the supply (quantity, quality) is beneficial to the downstream industry
- However :
  - it will not be possible to eradicate some of the pests / parasites
  - learning how to sustainably manage those pests/parasites is a mindset shift
- Last but not least :
  - Technology brings a lot of new solutions
  - However mother nature is often quicker and more creative to by-pass solutions developed by individual companies
  - We cannot do it all alone.
  - Partnering / Partnership

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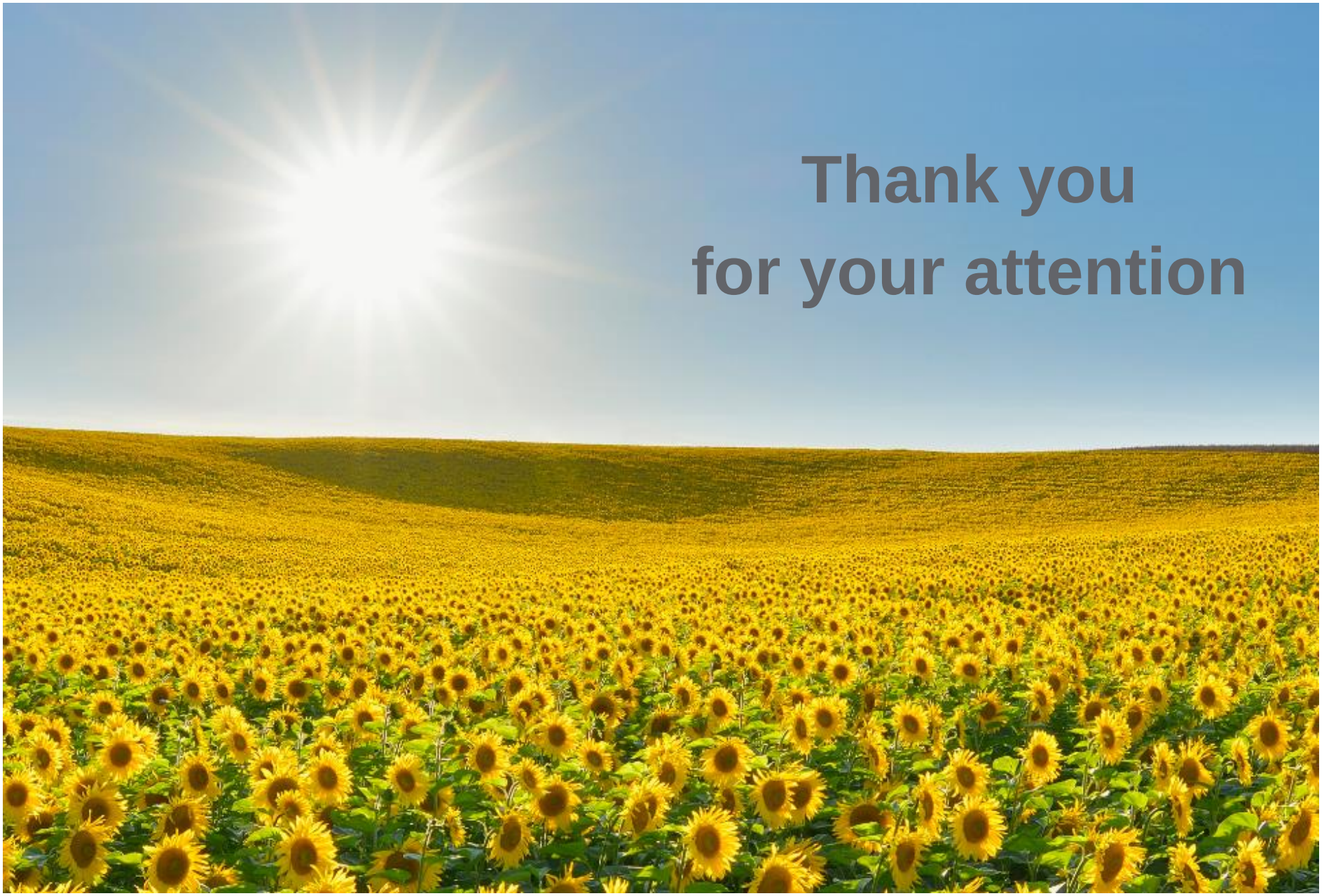

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- Syngenta Syngenta is your best partner for Sunflower development.
- Syngenta's sustainable intensification offer in sunflower includes services next to the products' offer (e.g. HO stewardship program with training for farmers, crop collectors and industries)

Bringing plant potential to life

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