PROTEIN CROPS

Winter peas

Growing guide

R·A·G·T

think **SOLUTIONS**
think **RAGT**

BREEDING HISTORY

RAGT works closely with NPZ. Since the beginning of their partnership, both companies have always shared the same values and invested in protein-rich crop breeding. While most companies have stopped, our companies have continued to invest in our 50 year old pulse breeding program.

Thanks to this cooperation, our Elite germplasm delivers a broad and original portfolio of solutions, which makes us the European leaders for spring peas & spring fava beans. Year after year, we consolidate our position in spring cycles and our strategy for the next few years is to implement winter pulses all over Europe for three main reasons:

- to support farmers in their transition from spring peas to winter peas when spring cycles are challenged by climate change
- to offer farmers the possibility of finding new solutions for their crop rotations.
- to contribute to protein sovereignty, affording new solutions to local production

Focus on winter peas

Winter pea breeding is quite rare in Europe. There are only 4 active breeding programs that deliver varieties to market. NPZ/RAGT are the only companies breeding both possibilities of spring and winter pea solutions with a wide range of benefits for Winter peas:

GOOD WINTERHARDINESS

High frost tolerant varieties: RGT FEROE / RGT CASINI / RGT LAPONY achieved the highest scores in frost tolerance by French official testing networks.

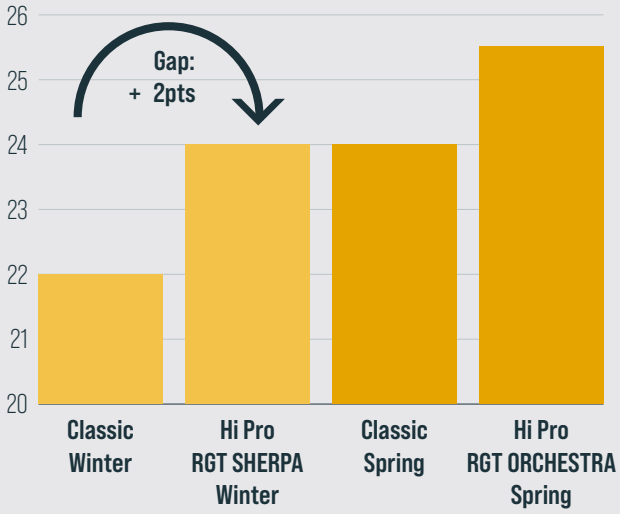
BACTERIAL WILT TOLERANT

Bacteriosis tolerance: this original trait has been developed by RAGT for 2 years now and gives the crop a better chance of survival after winter.

HIGH PROTEIN CONTENT

Hi protein segment: we deliver a hi pro winter pea variety with the same level as spring peas.

COMPARISON OF PROTEIN LEVEL BETWEEN WINTER & SPRING CYCLES



WHY GROW WINTER PEAS?

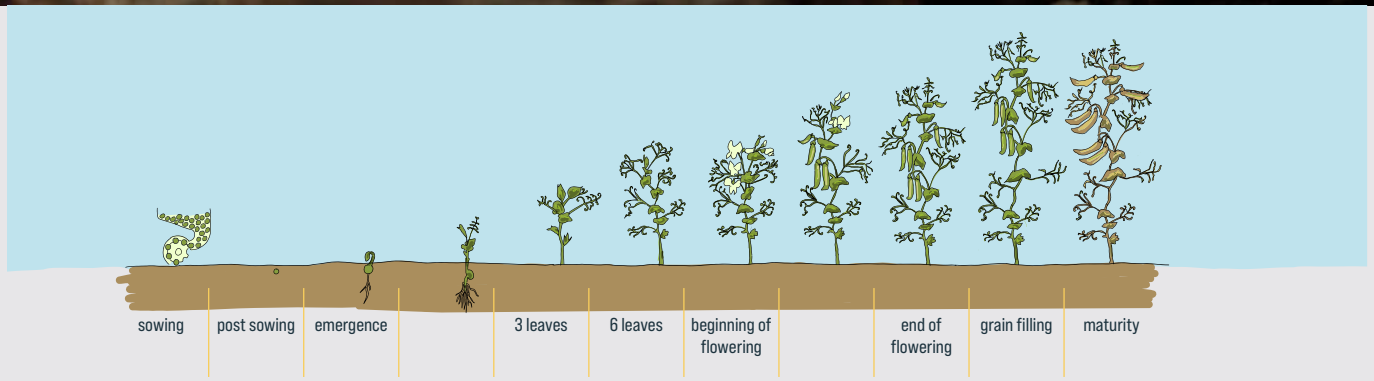
We estimate that 15% of European pea acreage is grown as winter peas. Mainly grown in southern Europe and France, we see a positive trend that consists in growing winter peas under northern latitudes and for the following main reasons:
- better yield potential: winter peas have a longer cycle, under southern latitudes crop yields are better than for spring cycles.
- Aphanomyce avoidance: winter peas flower before the attack so the yield impact of Aphanomyces is limited
- companion crop: winter peas are well adapted for companion planting with barley or early types of wheat.
- a new option for a winter crop within the rotation: especially when spring peas are not convenient or when farmers want to extend the rotation with a new head of rotation

Winter Peas ID Card

Why are winter peas different from spring peas?

Cycle

	Winter	Spring
Frost tolerance	**Yes**	No
Branching ability	**Yes**	No
TKW Range (g)	**180 -220**	220 -300
Protein range (%)	**20 - 23**	22 - 25

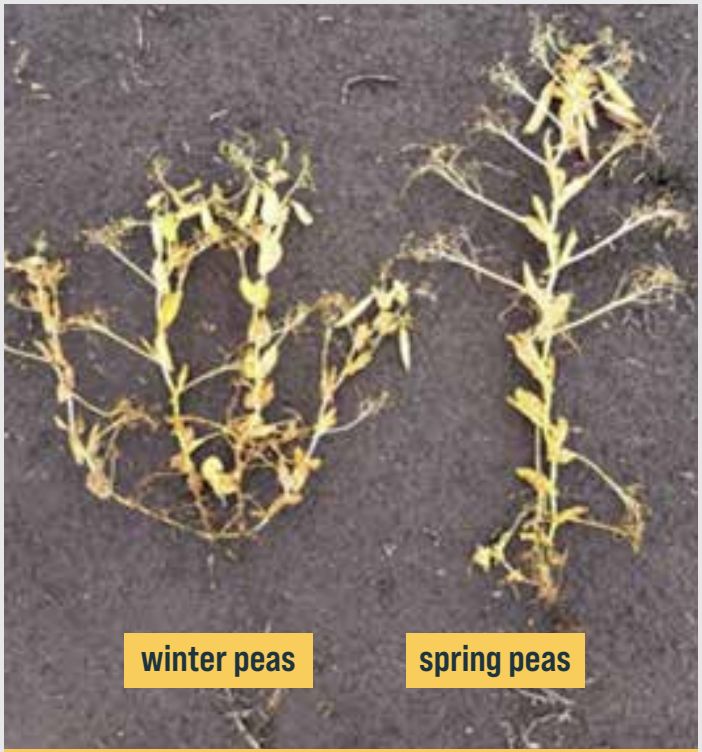


	Autumn			Winter			Spring			Summer		
Month	01	02	03	01	02	03	01	02	03	01	02	03
Winter		**Sowing**					**Flow**			**Harvest**		
Spring						Sowing			Flow		Harvest	

KEY POINT FOR GROWING WINTER PEAS

50% of the success of a winter pea crop depends on two key points:

- appropriate seed density and depth for the crop: avoiding over-density decreases the risk of disease
- sowing date compliance: to avoid advanced stages (more sensible to frost) before winter frost which can kill young plants.



Architecture comparison

Seed Density:

The plant architecture of winter peas differs from spring peas (Picture). Logically, winter peas require more space to grow than spring peas due to their branching capacity. Seed density must therefore be lowered compared to spring peas, for two reasons:

1. To avoid a surplus of plant density which boosts disease development
2. Over-density can also have a negative impact on yield and lodging *

Here, therefore, are some recommendations for planting winter peas:

Recommended seed density (source: Terre Inovia)

	Good soil	Rocky soil	Limestone soil
kernels/m²	70-60	90-80	115
Kg/ha (TKW=180)	125 - 105	160 - 140	210
Kg/ha (TKW=220)	155-130	200-175	250

Seed Depth:

the theoretical recommended depth of sowing is 4cm. It can be increased to 5-6 cm in limestone soil.

Sowing date:

Winter peas are spring peas with frost tolerance.
This means that winter peas never stop growing after planting and why they should be planted in the right slot to avoid excessively advanced stages before winter, which can be destroyed by frost.

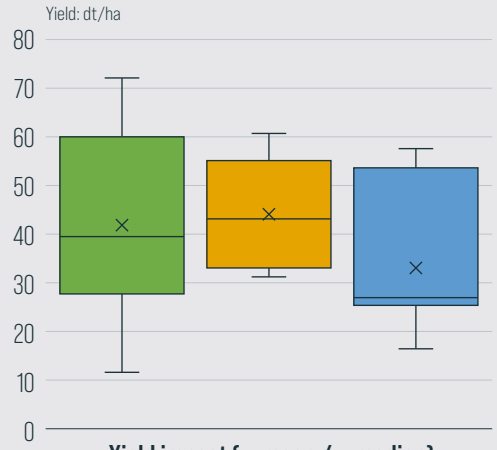
Below is a short table to explain the different situations:

	To be avoided: before 25/10	Ideal (01/11 to 25/11)	If there is no possibility of sowing: after 25/11
Frost risk	High	Limited	Limited
Disease risk*	High	Medium	Limited
Yield impact**	Moderate	Good	Moderate
Field accessibility	Easy to enter	Opportunistic	Difficult

**Yield impact: Terre Inovia has shown that a delayed sowing date has a moderate impact on the yield until January. After January, yields are more unstable due to the spring photoperiod.
*Disease risk: Terre Inovia has shown that delayed sowing decreases the risk.of disease Young plants are more resistant to frost at their early stages and therefore less exposed to frost damage at the critical end of winter period.

DATE OF SOWING TRIALS SYNTHESIS

source TERRE INOVIA - 7 trials, 3 years

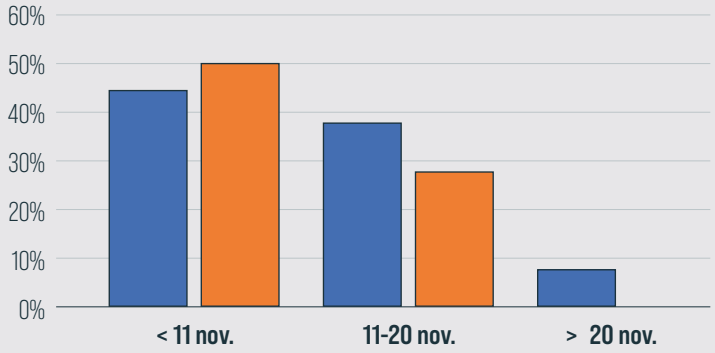


Yield impact (x: mean / -: median)

Legend:
Green:
ideal date of sowing
Yellow:
delayed date of sowing (1 month)
Blue:
delayed date of sowing (2 month)

DISEASE PRESSURE LEVEL IN DIFFERENT DATE OF SOWING SITUATIONS

source TERRE INOVIA - 27 winter peas frenchfield folllow up



Disease risk (mostly bacteriosis and Aschochyta pressures)

Legend:
Blue:
% average of the plants attacked by ascochyta
Orange:
% average of the plants attacked by bacteriosis

CROP MANAGEMENT:

3 main insects to watch out for in order to ensure a successful winter pea crop

Aphids

Name: Acyrthosiphon pisum

Insect host: Numerous

Impact: High

Frequency: Medium

When: Cool winter & hot and dry spring

How: Feed on upper leaves, stems and terminal buds

Symptoms: Flower abortion + withered leaves + malformation

Prevention: Avoid growing peas close to alfalfa or clover

Protection: Apply an insecticide on 20% or more of infested plants

Pea Leaf weevil

Name: Sitona lineatus

Insect host: Hedges, woods, fallow land, legumes

Impact: Low

Frequency: High

When: Spring, temp.>12°C and sunny days

How: Eat the leaves and lay eggs

Symptoms: Semi circular notches

Prevention: Sow a strip of vicia villosa (trap crop)

Protection: Apply an insecticide on 30% or more of infested plants

Pea moth

Name: Cydia nigricana

Insect host: Vetch, clover and lentil

Impact: Medium

Frequency: High

When: Spring, temp.>18°C

How: Lay eggs and the caterpillar grows in the grains

Symptoms: Holes in the grains

Prevention: Use pheromone traps to detect the infection in advance

Protection: Apply an insecticide on 100 captures accumulated from the beginning of flowering

4 main diseases to watch out for in order to ensure a successful winter pea crop

After winter, the crop will start the branching and vegetative processes. During these processes, winter peas are subjected to specific foliar disease attacks:

Bacteriosis

Pathogen: Pseudomonas synringae pv pisi
Disease transmission: Soil & seeds
Impact: Medium
Frequency: Random
When: After winter
How: After frost damage with varieties prone to the disease
Symptoms: Small dark green spots on the leaves, which evolve into irregular and angular dark brown shapes
Prevention: Respect the date of sowing, choose tolerant varieties, use certified seeds
Protection: No treatment available

Colletotrichum + Ascochyta pisi + bacteriosis complex

Pathogen: Colletotrichum sp., Ascochyta, Pseudomonas Synringae
Disease transmission: Seeds & crop residues
Impact: High
Frequency: Random
When: After winter through to flowering
How: High humidity and moderate temperatures
Symptoms: On the leaves light rounded spot with a brown halo that becomes orange when mature
Prevention: Comply with date of sowing, Use certified seeds
Protection: Prepare an adapted fungicide treatment early enough

Photo credits: Terres Inovia

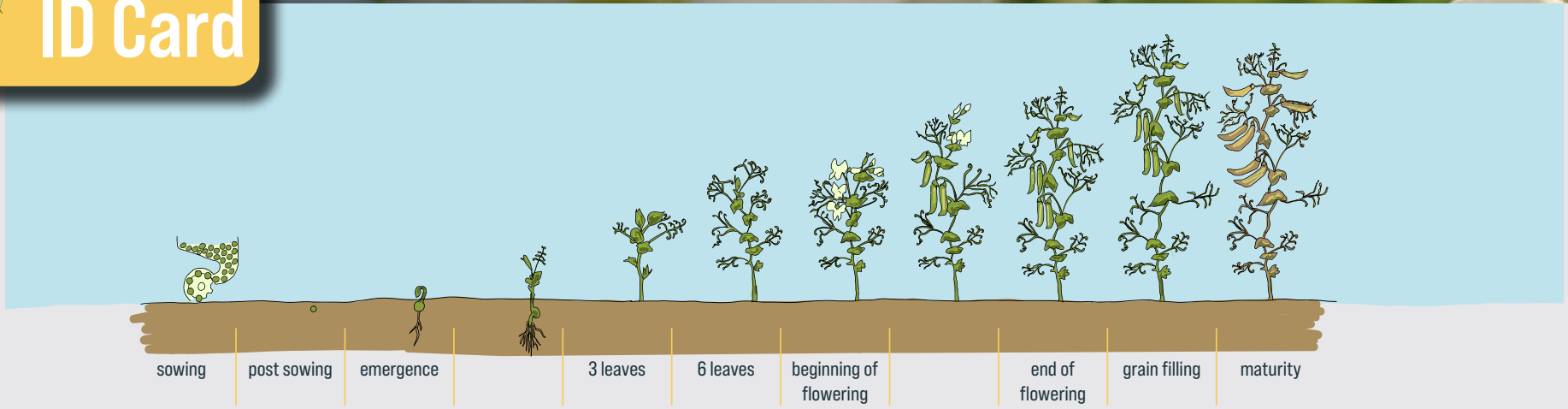
Ascochyta

Pathogen: Didymella pinodes, Phoma medicagnis var pinodella & Ascochyta pisi
Disease transmission: Crop residues, wind & seeds
Impact: High
Frequency: High
When: Beginning of spring (flowering)
How: High humidity and temperature >22°C
Symptoms: Brown stem + circular brown spots on the leaves
Prevention: Comply with the seed density recommendation to avoid compact vegetation and frost tolerant variety
Protection: Prepare an adapted fungicide treatment early enough

Downy Mildew

Pathogen: Peronospora pisi
Disease transmission: Seeds & soil
Impact: High on young plants
Frequency: Random
When: After sowing through to flowering
How: High humidity and temperatures < 18°
Symptoms: Discolouration on the upper surface of the leaves with grey felting on the underside.
Prevention: Use variety tolerant to downy mildew
Protection: No treatment available

Winter Peas ID Card



	Autumn			Winter			Spring			Summer		
Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
Frost tolerance	-10°C			-15°C		-5°C	0°C					

Diseases:

Bacteriosis				■	■	■						
Ascochyta					■	■	■	■	■	■	■	
Colletotrichum				■	■	■	■	■	■	■	■	
Downy mildew			■	■	■	■	■	■				

Insects:

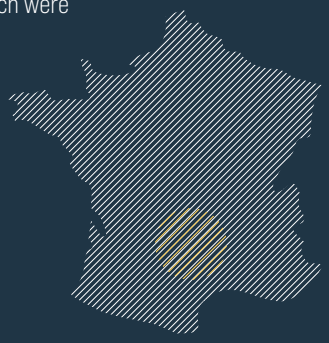
Aphids			■	■		■	■	■	■			
Pea leaf weevil				■	■	■						
Pea Moth							■	■				

■ area of vigilance

DID YOU KNOW?

RAGT originates from 4 regions situated across France, all of which were used to create its name:

> Rouergue
> Auvergne
> Gévaudan
> Tarnais



ABOUT RAGT

RAGT breeds, produces and sells seeds globally. Varietal innovation is at the heart of its activity. With 32 species, RAGT has one of the largest species portfolio in the seed industry: maize, sorghum, cereals, oilseeds, protein, forage, cover and amenity crops.

RAGT is the European leader in cereals and protein-rich species.

RAGT is recognised for the quality of its forage crops.

RAGT is an innovator in cover crops to support and develop sustainability in agriculture.

RAGT SEED FIGURES

#1 European cereals leader

#1 Global spring barley leader

#1 European protein crop leader

20 Business subsidiaries

22 Breeding stations

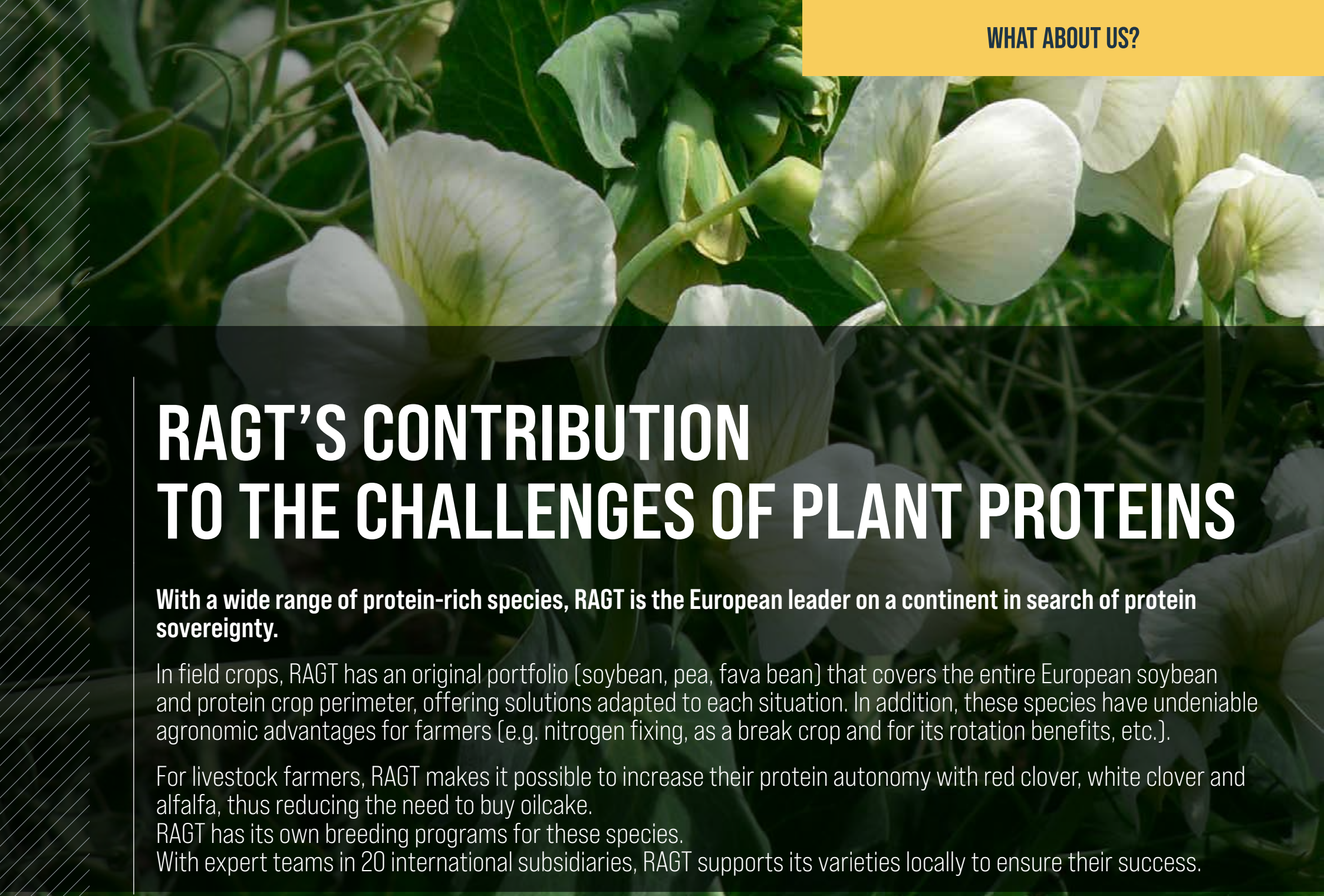
48 Sales in 48 countries

17% Involved in breeding

32 Species

52 Breeding programs

1,000 Employees (FTE)



RAGT'S CONTRIBUTION TO THE CHALLENGES OF PLANT PROTEINS

With a wide range of protein-rich species, RAGT is the European leader on a continent in search of protein sovereignty.

In field crops, RAGT has an original portfolio (soybean, pea, fava bean) that covers the entire European soybean and protein crop perimeter, offering solutions adapted to each situation. In addition, these species have undeniable agronomic advantages for farmers (e.g. nitrogen fixing, as a break crop and for its rotation benefits, etc.).

For livestock farmers, RAGT makes it possible to increase their protein autonomy with red clover, white clover and alfalfa, thus reducing the need to buy oilcake.
RAGT has its own breeding programs for these species.
With expert teams in 20 international subsidiaries, RAGT supports its varieties locally to ensure their success.

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SAS capitalised at €43,275.010

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