



SOYBEAN TECHNICAL GUIDE





GET TO KNOW SOYBEAN

SOYBEAN ORIGINS

Soybean (*Glycine max*) is an annual plant of the Fabaceae family (legumes).

It was first cultivated in Manchuria (eastern China), around 3,000 BC. The plant gradually became an essential food for the people of the Far East. Explorers then brought it back to Europe where, in the 17th century, it made its appearance as a fodder plant.

Soybean underwent a major evolution at the beginning of the 20th century, under the influence of the United States, which carried out extensive research to adapt the plant to the climate and industrialise its cultivation.

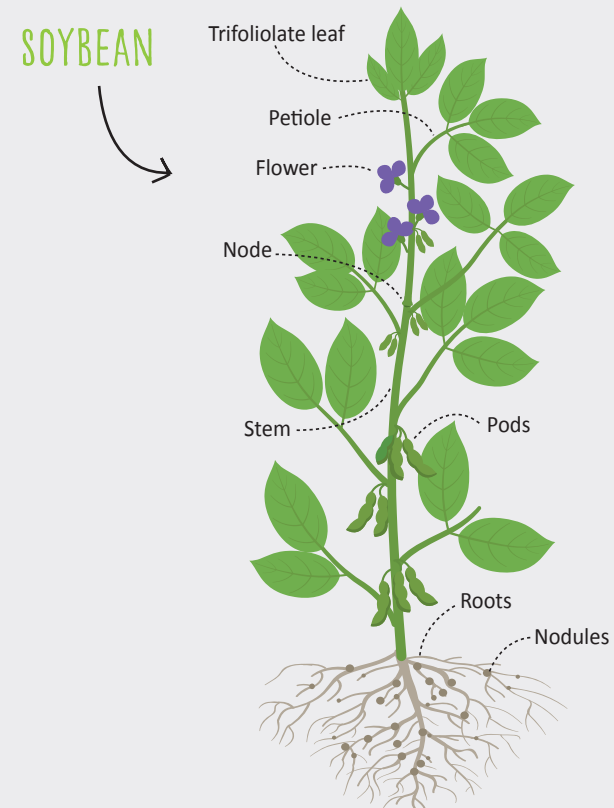
The days when soybean was only found in China are over: the plant is now cultivated on all five continents, with a clear dominance in the Americas.

Source: Terres Inovia

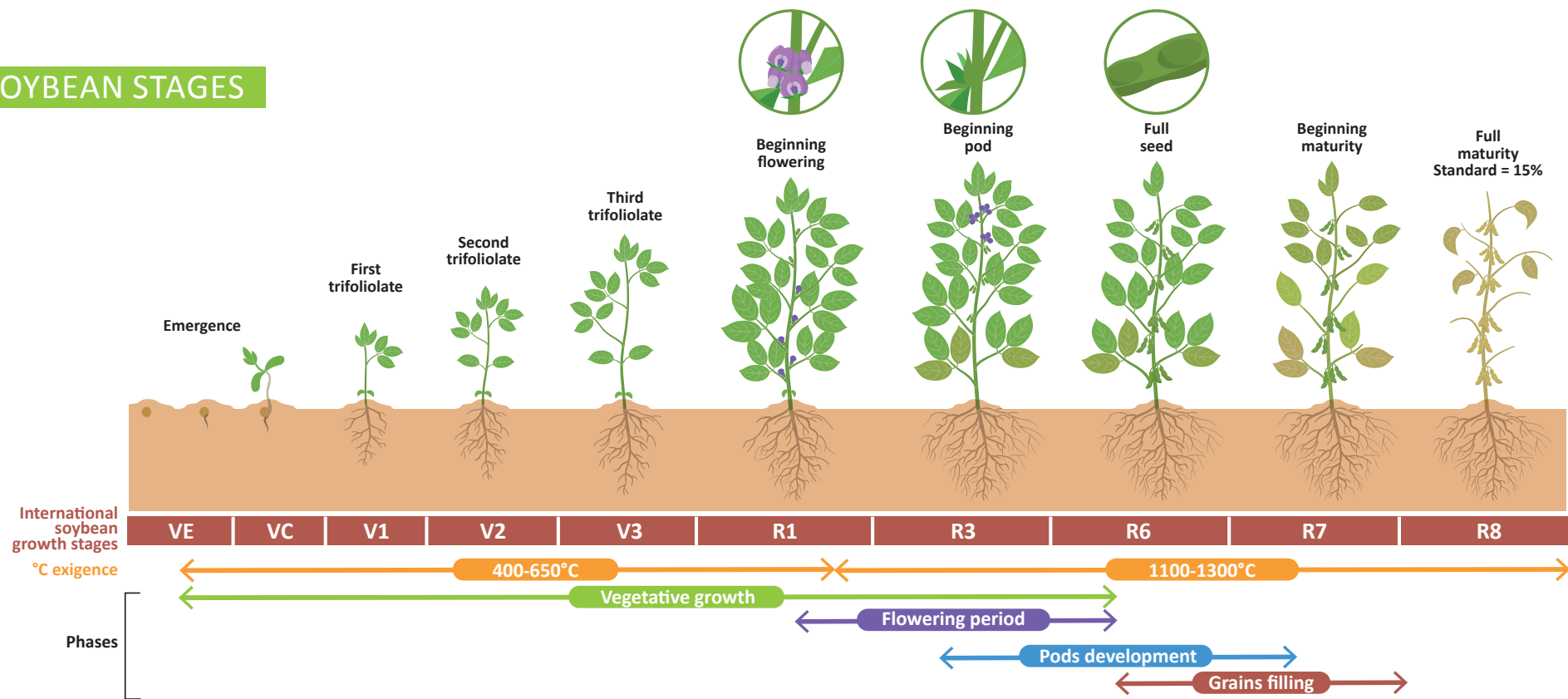


PLANT DESCRIPTION

- Soybean is a leguminous plant, so nitrogen fertiliser is not required.
- Soybean is the plant with the highest protein content (40-45%), but also widely used for oil.
- Soybean is the N°1 protein crop cultivated all over the world (> 130 millions ha).
- **3 different growth type:** determinate, semi-determinate, indeterminate.



SOYBEAN STAGES



USES OF SOYBEAN



ANIMAL FEED

- Due to its very high protein content and quality, soybean meal is the No. 1 source of proteins for animals (pigs, poultry, livestock, fish, etc.).



HUMAN FOOD

- Soy milk, yoghurts, flour, etc.
- Meat substitutes (textured protein, protein isolates, etc.)
- Soy sauce, tofu, etc.



INDUSTRY

- The crop is used in the production of wood adhesives, rubbers and plastics, textiles, resins, paints, cosmetics, etc...



FOR OIL

- Soybean contains approximately 20% oil.
- Used for human food (No. 1 for oil use in the USA).
- Used on a massive scale in animal feed and biodiesel.



GET TO KNOW SOYBEAN

SOYBEAN CROP ADVANTAGES



LOW INPUTS:

- Does not require nitrogen thanks to the inoculated rhizobium.
- Low need of fungicides and insecticides.



STRATEGIC COMPONENTS

- **PROTEIN:** soybean is the crop with the highest quantity of protein/ha in the world. It provides an average protein content of 40-45% of dry matter and all the essential amino acids needed to fulfil human and animal nutritional requirements.
- **OIL:** around 20%. Soybean is a source of high-quality vegetable oil for human food, animal feed and biodiesel.
- **MINOR COMPONENTS:** lecithin, tocopherols, saponins, glycerol and phytosterols. Soybean has potential benefits for human health due to its anti-oxidant effects.



AN EXCELLENT CROP FOR ROTATION:

- to leave residual nitrogen in the soil for subsequent crops;
- to break certain weed cycles;
- to limit mycotoxins in cereals;
- to manage certain diseases (e.g. Diabrotica on corn roots).



AN EXCELLENT CROP FOR ALL USES:

animal feed, human food, biodiesel, industrial applications, etc.

As a result of these qualities, soybean has become a strategic crop to respond to the growing global demand for proteins and make European protein independence possible.

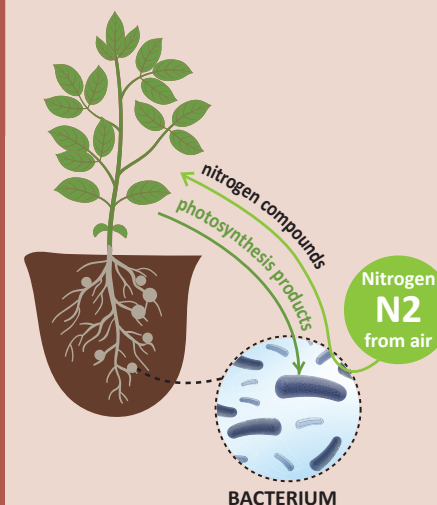


0 KG OF NITROGEN INPUT!

Like other legumes, soybean captures free nitrogen from the air and converts it into ammoniacal nitrogen using the bacteria *Bradyrhizobium japonicum*.

These nitrogen fixing-bacteria colonise the roots of the soybean plant by forming nodules.

The combination of nitrogen fixation and nitrogen from the soil should be sufficient for soybean crops, without additional fertiliser.



SOYBEAN CERTIFIED SEEDS ADVANTAGES

- 🔪 **HIGH QUALITY SEED GUARANTEE:** variety purity (>99%), germination (>80%), allowing maximum soybean emergence and growth to obtain optimum yield.
- 🔪 **STRICT WEED CONTROL** (including invasive weeds such as Cuscuta, Avena, etc.), avoiding the contamination of cultivated fields and making weed management easier and cheaper.
- 🔪 **STRICT CONTROL OF THE PRESENCE OF OTHER CROPS TO:**
 - avoid the presence of gluten crop seeds to enable soy food companies to offer non-gluten products;
 - avoid the presence of sunflower seeds and especially Clearfield resistant seeds that cannot be treated by Pulsar®.
- 🔪 **STRICT CONTROL OF DISEASES** in seed production (e.g. Diaporthe, mosaic virus, Phytophthora, etc).
- 🔪 **TRACEABILITY** providing a guarantee for soybean food or feed companies in relation to specific product characteristics (e.g., high protein content, grain colour, etc.).
- 🔪 **GMO-FREE GUARANTEE** for the farmer's whole field and the industry.
- 🔪 **PURCHASING CERTIFIED SEEDS** contributes to R&D investment and genetic progress to increase yield, protein content and quality, disease tolerance, etc. This will ensure that soybean remains a sustainable and competitive crop for farmers and industries over the long term.



Soybean certified seeds brochure



KEY POINTS FOR SOYBEAN CROP SUCCESS

1

CHOOSE
THE FIELD

2

PREPARE
THE SOIL

3

CHOOSE
VARIETIES

4

+

5

SOWING
INOCULATION

6

CONTROL
WEEDS

1 CHOOSE THE FIELD

OBJECTIVE: obtain good root development

- Soybean can be cultivated on many soil types. However, limestone soils should be avoided when lime content is higher than 10%. Such soils can cause iron chlorosis, limit nodulation and dramatically reduce soybean growth.
- If there is no irrigation, avoid soils with low water holding capacity (superficial clay-limestone soils, sand, etc.) that result in low yields and more irregular protein content.

2 PREPARE THE SOIL TO ENSURE GOOD AND QUICK EMERGENCE

OBJECTIVE: obtain good soil structure and a good seed-bed

- Reduce compaction.**
- Obtain **sufficiently refined soil** and a well-levelled ground surface, so that cotyledons can emerge from the soil quickly and easily.

3 CHOOSE VARIETIES ACCORDING TO 5 CRITERIA

OBJECTIVE: adapt to the local area

- Earliness:** adapt the choice to the region and to the sowing date.
- Productivity / Yield**
- Diseases tolerance,** especially to sclerotinia
- Lodging tolerance:** good tolerance makes the harvest easier and limits sclerotinia development in critical situations where irrigation is used.
- Protein content:** a high protein content is required, especially for use in human food.

4 GOOD INOCULATION

OBJECTIVE: inoculate with care and with high quality inoculants

- All plots must be inoculated even if soybean has already been grown on them. This will optimise yield and protein content.
- Inoculation must be carefully carried out because bacteria and seeds are fragile and can be damaged by heat and sun.
- 3 ways to inoculate soybean with Rhizobium bacteria:
 - Buy certified seeds which have been pre-inoculated in seed factories (e.g. Hi-Coat Super, Rhizoliq LLI, Optimize 400, etc.).
 - Mix certified seeds with peat or liquid inoculants (e.g. Hi-Stick/Force 48).
 - Use microgranular inoculants.

5 GOOD SOWING

OBJECTIVE: ensure successful emergence

- Sow when soil temperature has warmed up** (more than 10°C). It is recommended to use a high precision sowing machine.
- Adapt the sowing rate** to the earliness group, seed germination, sowing conditions, and irrigation. Without irrigation, increase the density, because some plants will die and plants will have smaller development.
- Distance between rows:**
 - 18 to 30 cm for group 000
 - 18 to 50 cm for group 00
 - 25 to 60 cm for groups 0, I and II
- Protection against pests:** not systematic but should be adapted to the risks.

RECOMMENDED SOWING DENSITY

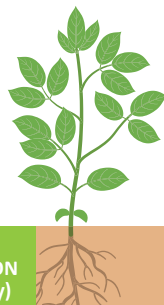
EARLINESS	ROW DISTANCE (cm)	IRRIGATION	EMERGED PLANTS OBJECTIVE (Plants/Ha)	PLANTING DENSITY WITH LOW LOSS 10% (Kernels/Ha)	PLANTING DENSITY WITH HIGH LOSS 20% (Kernels/Ha)
000	18-30	No irrigation	600.000	670.000	750.000
000	18-30	With irrigation	550.000	600.000	660.000
00	18-50	No irrigation	550.000	610.000	690.000
00	18-50	With irrigation	500.000	550.000	625.000
0	25-60	No irrigation	500.000	550.000	625.000
0	25-60	With irrigation	400.000	440.000	500.000
I	25-60	No irrigation	450.000	500.000	580.000
I	25-60	With irrigation	350.000	390.000	440.000
II	25-60	No irrigation	400.000	440.000	500.000
II	25-60	With irrigation	300.000	330.000	375.000

6 WEED CONTROL

OBJECTIVE: prevent weed development

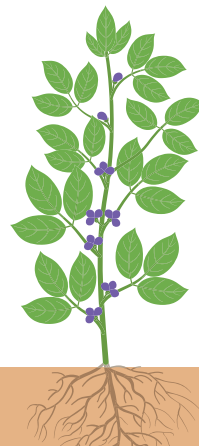
- Controlling weeds on plots is a key issue. Indeed, soybean is a plant that covers the soil slowly and certain weeds can affect productivity and the quality of the harvest. There are several ways to control weeds:
 - First, crop rotation can break the cycle of certain weeds by alternating spring crops and autumn crops.
 - Soil preparation techniques can also influence the presence of weeds. Ploughing and the stale seed bed method can reduce weed seed stocks.

7

CHECK
NODULATIONIRRIGATION
(if possible)NITROGEN
FERTILISATION
(if necessary)

8

+ 9

WATCH DISEASES
AND INSECTS

10

HARVEST



- Finally, there are chemical (post sowing, pre and post-emergence) and mechanical solutions to eliminate weeds.
- As some varieties are sensitive and may show signs of phytotoxicity, the following recommendations should be followed:

- **Metobromuron:** to avoid lack of selectivity, never spray more than 4 days after sowing and adapt the dosage to the soil composition. Molecule recommended for Ambrosia.
- **Pendimethalin:** a lack of selectivity can occur especially in sandy soils.
- **Pulsar 40®:** in case of heavy rain, high temperature or excessive plant development, yellow marks may appear but they disappear quickly.
- **Be careful:** Pulsar® and CORUM® can cause molecules from previously used herbicide to be released from the sprayer and filter, leading to soybean phytotoxicity. Sprayers must be carefully cleaned with suitable products before using Pulsar®.

7 CHECK NODULATION AND FERTILISATION

OBJECTIVE: avoid nitrogen deficiency

- If leaves are becoming yellow and if more than 30% of plants are not showing nodules, apply some nitrogen (this means that inoculation did not work).
- Depending on the soil nitrogen supply, apply (in one or 2 applications) 80 to 150 units between stage R1 (beginning of flowering) and stage R3 (first pods), if possible prior to irrigation. Use of the perlure (urea) form is recommended.

- **Critical areas:** obtain information specific to each region to establish whether it is permitted to apply nitrogen to legumes.

8 IRRIGATION

OBJECTIVE: increase and secure yield performance

- Do not irrigate before the beginning of flowering.
- Irrigate up to 20 days before harvest.
- Adapt water requirements to soil and climate.

9 WATCH DISEASES AND INSECTS

OBJECTIVE: preserve yield performance and reduce insect pressure

- **SCLEROTINIA** (*Sclerotinia sclerotiorum*)
 - If sclerotinia has already been observed on other crops on the field, soybean will also be at risk. Irrigation or rainy weather will increase sclerotinia development.
 - Use a variety with a low susceptibility to sclerotinia.
 - Adapt irrigation by spacing out sessions while increasing water amount per session to avoid a "hammam" effect that contributes to the development of sclerotinia.
- **DIAPORTHE** (*Diaporthe phaseolorum* + var *caulivora*)
 - Characterised by a sudden dryness at the end of the cycle with small black points on the stem and pods (pycnidia) or superficial red-brown spot at a node (var *caulivora*).
 - Develops with high moisture and temperature before harvest.
 - This disease is spread by farm saved seeds so the solutions are to use certified seeds and bury crop residues.

• SEED FLIES / MAGGOT (*Delia platura*)

- Can cause important damage if emergence conditions are cold and humid with early and deep planting, especially in the soils with high organic matter.
- The only solution is to plant in more favourable conditions to obtain quick emergence.

• GREEN STINK BUG (*Nezara viridula* L.)

- Observe the crop from mid-July to mid-August once a week on 6 to 8 points over a few square metres, at the edge and inside the field.
- If bugs are found (2 to 3 minimum) on each second observation point, treatment is advised.
- Some insecticides can be used but not later than 15 days before harvest. Check with local authorities the molecules and dosages allowed.

• HELICOVERPA ARMIGERA / HELIOTHIS

- Attacks depend on arrival date and number of generations.
- Observations and pheromone traps allow to apply insecticide at the best time. Biological treatments (*Bacillus thuringiensis*, baculovirus) are efficient on eggs and young larvae. Irrigation and crop rotation are also good solutions.

10 GOOD HARVEST

OBJECTIVE: get the best yield performance

- Harvest when most leaves have fallen: kernel moisture ranks then **between 14 and 16%** (below 14% the pods will open and the kernels will be broken).
- Use combines with flexible cuts to harvest even the lowest pods.



EURALIS Seeds and CAUSSADE Semences Group formalised their alliance on September 2020 by creating **Lidea**. This merge allows **Lidea** to enter the Top 10 of the seed companies in the world. Lidea Seeds creates and provides customised, sustainable multi-crops seed solutions that generate added value for producers all year round.

Lidea creates, produces and sells seeds of corn, sunflower, soybean, rapeseed, sorghum, pulses, cereals, forage and cover crops all over the world.



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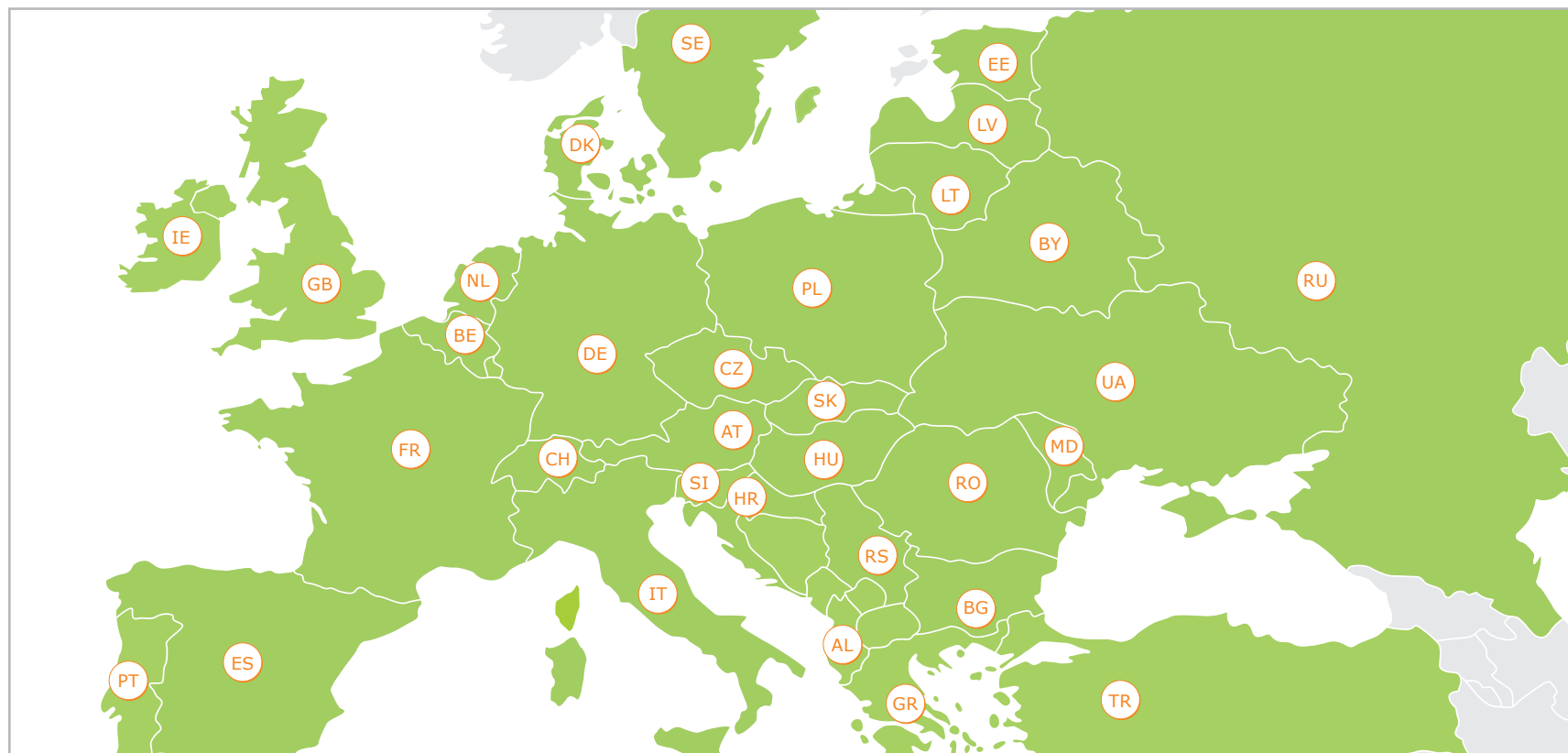
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