

Spain dossier

Water, climate, fertilisers and crops: Figures by autonomous community and crop, potential benefits of our products and foreign trade

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Information and discussion document. The scenarios are hypotheses that must be validated through trials in Spain.



Introduction

This document describes Spain from the perspective of irrigation water, climate, fertilisers and crops. It answers three questions: Where is water used? For which crops? And at what price? It then examines what our products can change and what they might be worth.

Reading the sources. Each figure refers to a source, identified in the text and detailed in Annex A. Each source has a confidence level:

> **How to read this document**
> • **A**: Official statistics or an international database (Eurostat, World Bank, European Commission).
> • **B**: Research institute, university, laboratory or non-statistical public body.
> • **C**: Manufacturer's statement, non-independent demonstration, press report or estimate.
> • "Bn" means billions; "M" means millions.
> • A "scenario" is a calculation based on the cited trials. It is not a measurement carried out in Spain.

What this document does not do. It does not turn a trial carried out elsewhere into a Spanish result. Water savings and yield gains by crop are **scenarios**, built from the cited trials. The document does not state any selling price.

What remains to be completed. Rainfall normals by autonomous community and quantified regional projections. Section 11 provides details.

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Summary

The following seven points summarise this document. The six key figures come from public sources (Eurostat, World Bank, PVGIS, MAPA-Mercasa). Water savings are scenarios, described in Annex B.

17.4 bn m³
of water abstracted for irrigation in 2020 (Eurostat), i.e. 18.5% less than in 2010.

2.74 M ha
of irrigated land in 2023, i.e. 11.7% of utilised agricultural area (Eurostat).

1,885 Mm³
of water saved per year in the central scenario, i.e. 11% of water abstractions for irrigation.

551 M€
of value per year in the central scenario, at €0.22/m³, including the yield gain.

75.1 bn€
of agri-food exports in 2024 (MAPA-Mercasa), compared with 55.9 bn€ of imports.

871,886 t
of mineral nitrogen used in 2024 (Eurostat). Indicative expenditure: 1.2 bn€.

Seven key points

1. Irrigation is the largest use of water. In 2020, 17.4 billion m³ were abstracted for irrigation: 59% of all freshwater abstractions and 92% of those for agriculture, forestry and fishing (Eurostat). This volume has fallen by 18.5% since 2010.

2. An irrigated area of 2.74 million hectares, i.e. 11.7% of utilised agricultural area. Andalucía, Castilla-La Mancha, Castilla y León and Aragón account for about 70%.

3. Highly contrasting solar radiation. From 1,267 kWh/m² per year (Oviedo) to 2,091 kWh/m² (Santa Cruz de Tenerife), while Sevilla reaches 1,887 kWh/m².

4. Fertilisers are expensive. Mineral nitrogen used fell from 1,059,299 t in 2020 to 871,886 t in 2024. Indicative expenditure reached 1.2 billion euros in 2024, compared with 1.4 billion in 2022 (price peak).

5. Potential water savings are substantial. In the central scenario, 1,885 million m³ per year, i.e. 11% of water abstractions for irrigation, worth around 551 million euros per year at €0.22/m³. The range is 0.9 to 3.8 billion m³.

6. Gains depend on the crop. Maize and vegetables benefit more from the trials; cereals, which are widespread, benefit less. Potatoes are based on a single trial.

7. Trade depends on water. Agri-food exports of 75.1 billion euros in 2024 and imports of 55.9 billion. Imported maize (9.4 Mt) is equivalent to around 2.6 times domestic production (3.5 Mt), 88% of which is grown on irrigated land.

Next steps

- Complete rainfall normals by autonomous community (AEMET, 1991–2020) and official irrigation volumes (INE, MAPA).
- Verify fertiliser expenditure against the ministry's official accounts.
- Select one or two autonomous communities for a comparative trial in Spain before any expansion.

Key figures

Key indicators for Spain

Indicator	Value	Year	Source (level)
Water abstractions for irrigation	17,360 million m³	2020	Eurostat (A2)
Irrigated area	2,739,250 ha (11.7% of UAA)	2023	Eurostat (A3, A4)
Average solar radiation (autonomous community capitals)	1,267 to 2,091 kWh/m²/year	2005–2020	PVGIS (A10)
Mineral nitrogen used	871,886 t	2024	Eurostat (A7)

Indicator	Value	Year	Source (level)
Potential water savings (central)	1,885 million m³/year	scenario	Calculation (Annex B)

Source: See the "Source" column; levels are explained in the introduction.

1. Green Solutions and our products

Green Solutions develops products for water, fertilisation and crop protection. Four product families are relevant to this document. The results cited are those published by the manufacturer or from trials, together with their confidence level.

Products included in this document

Product	Claimed use	Published evidence	Level
EVERGREEN® (hydrogel)	Retains rainwater or irrigation water as a gel close to the roots	Trials on maize, potatoes, watermelon, date palm and soya (sections 8 and 9)	B to C
ECOSORB® (maize-starch-based hydrogel)	Same use; lifespan of 2 to 3 years according to the website	Soya trial (China); laboratory analysis of acrylamide	B to C
ECOFERT® (fertiliser)	Fertiliser certified by SOHISCERT and EU Bio	Published certificate; potato trial combined with EVERGREEN	A (certificate), C (results)
Paulownia ALTIFOLIA®	Fast-growing tree for agroforestry	Figures from the website; no trial in Spain	C
Water Vital®, NAPEMA®	Outside the scope of this document	No independent source in the documents consulted	—

Source: Green Solutions website (product sheets and published trials), Annex A, sources A22 to A32.

A horticultural training institute in France is among our pilot horticulture trials with ECOSORB® and ECOFERT®. It is a field reference, not a statistical demonstration (level C).

The indicative dose published on the website is **30 to 75 kg/ha**.

2. Spain in figures

Spain has around 49 million inhabitants and an economy of close to $1.9 trillion. Agriculture accounts for only 2.7% of gross domestic product, but food accounts for almost 20% of goods exports. The following table sets out the latest national data.

National data

Indicator	Value	Year	Source
Population	49.36 million inhabitants	2025	World Bank (A1)
Gross domestic product	$1,906 billion at current prices	2025	World Bank (A1)
Agricultural value added	2.7% of GDP	2025	World Bank (A1)
Agricultural land	49.3% of the country's area	2024	World Bank (A1)
Cropland	11.38 million hectares	2024	World Bank (A1)
Utilised agricultural area (UAA)	23.42 million hectares	2023	Eurostat (A3)
Irrigated area	2.74 million hectares, i.e. 11.7% of UAA	2023	Eurostat (A3)
Irrigated land (another definition)	15.2% of agricultural land	2024	World Bank (A1)
Fertilisers used	136 kg/ha of cropland	2024	World Bank (A1)
Freshwater abstractions	26.1% of internal resources	2022	World Bank (A1)
Agriculture's share of abstractions	65.3%	2022	World Bank (A1)
Internal water resources	2,327 m³ per inhabitant per year	2022	World Bank (A1)
Average precipitation	636 mm per year	2022	World Bank (A1)
Forests	38.2% of the area	2024	World Bank (A1)

Indicator	Value	Year	Source
Cereal yield	3,786 kg/ha	2024	World Bank (A1)
Food exports	19.5% of goods exports	2025	World Bank (A1)
Food imports	12.9% of goods imports	2025	World Bank (A1)

Source: World Bank, WDI database (A1); Eurostat, 2023 agricultural census (A3, A4).

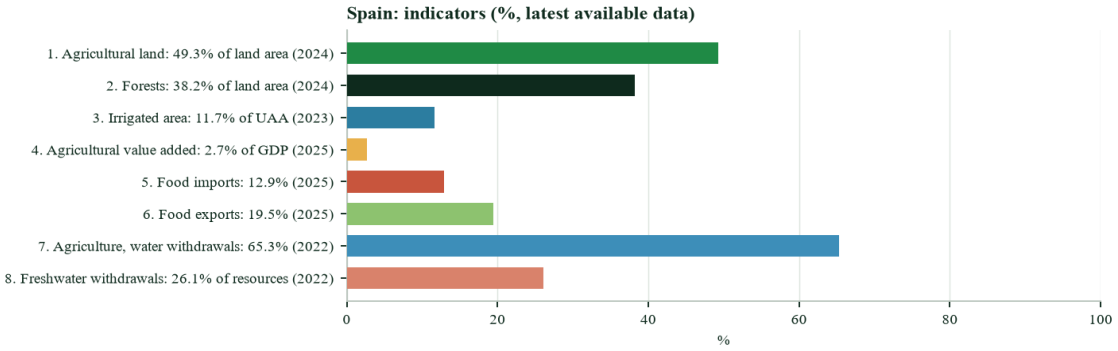


Figure 1. Spain in indicators (in %, latest available data). Source: World Bank (A1); Eurostat (A3); author's calculation.

Two figures for irrigation

The difference between the two irrigation figures (11.7% for Eurostat, 15.2% for the World Bank) is due to the definitions: The census measures the utilised agricultural area of holdings, while the World Bank measures agricultural land. This document uses the Eurostat figure in all calculations.



Cultivated fields seen from an aeroplane.

3. Solar radiation, rainfall and climate change

3.1 Solar radiation

Average horizontal solar radiation over 2005–2020 ranges from around 1,300 kWh/m² per year in the north to more than 2,000 kWh/m² in Canarias (PVGIS, European Commission, source A10). The values are taken at the capital of each autonomous community: They are reference points, not regional averages.

High sunshine increases evaporation: A crop in the south generally needs more water than one in the north. This relationship is not quantified here; the calculation of water per hectare (section 4) remains a national average.

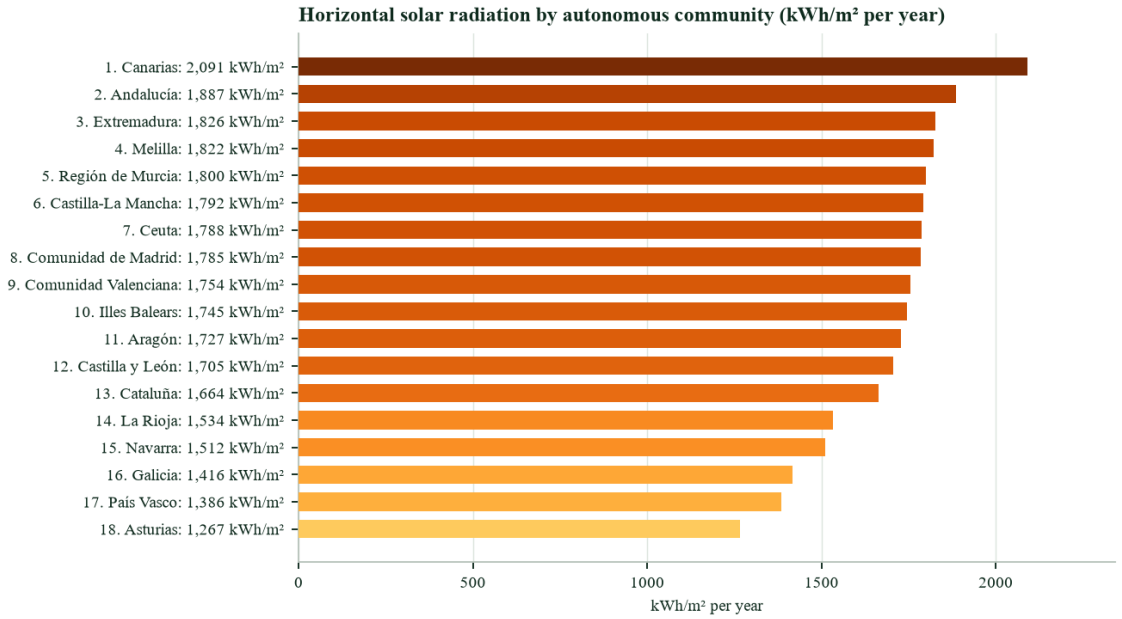


Figure 2. Horizontal solar radiation by autonomous community (kWh/m² per year, capital of the autonomous community). Source: PVGIS, European Commission (A10), 2005–2020 average, author's calculation. Cantabria: Value not obtained.

3.2 Rainfall

Precipitation data

Data	Value	Period	Source (level)
Average precipitation in Spain	636 mm per year	2022	World Bank (A1)
Observed hydrological year	689.8 mm, compared with a normal of 640.2 mm	Feb. 2024 – Jan. 2025	MITECO (A13, B)
Rainfall deficit for the season	17.1% below average	2022-2023	Agricultural press (C)

Source: See Annex A.

> **What is missing**
>
> **Rainfall normals by autonomous community (AEMET, 1991–2020) could not be obtained for this work.** The table therefore remains national. Regional rainfall data must be completed before any submission (section 11).

3.3 Climate change and rainfall by autonomous community

There are few available quantified projections, and they come mainly from press reports or secondary reports. The following table brings them together, with their confidence level.

Rainfall and river-flow projections

Projection	Horizon	Value or trend	Source (level)
Rainfall, mainland Spain and Baleares	2050	−14 to −20%, if warming continues at the rate observed from 1973 to 2022	UPC study cited by the press (A16, C)
River flow (scenario A2)	2040 / 2070 / 2100	−8%, −16%, −28%	CEDEX, cited by Ecologistas en Acción (A15, B)
Rainfall, north-west (Galicia, Asturias, Cantabria)	2050	Decline, the greatest in the country	Observatorio de la Sostenibilidad, cited (A17, C)
Rain, Comunidad Valenciana, Navarra, western Canary Islands	2050	Possible slight increase	Observatorio de la Sostenibilidad, cited (A17, C)
Rain, other communities	2050	Decrease	Observatorio de la Sostenibilidad, cited (A17, C)

Source: Annex A (A15 to A17).

The AEMET–MITECO chapter on trends (A14) confirms the warming observed in Spain. Its regional maps are not legible in the version consulted: Therefore, no regional figure from this document is included.

A decline in average rainfall does not rule out more violent storms. The press reports this (level C).

4. Irrigation water: Volumes, prices, investment, drought



Five forms of irrigation: Schematic diagram.

4.1 Volumes abstracted

Water abstracted, in million m³ per year

Use	2010	2020	Change 2010–2020
Irrigation (surface water and groundwater)	21,300	17,360	-18.5%
Agriculture, forestry and fishing	23,360	18,960	-18.8%
Total freshwater abstraction	35,310	29,446	-16.6%

Source: Eurostat, env_wat_abs (A2); surface water and groundwater.

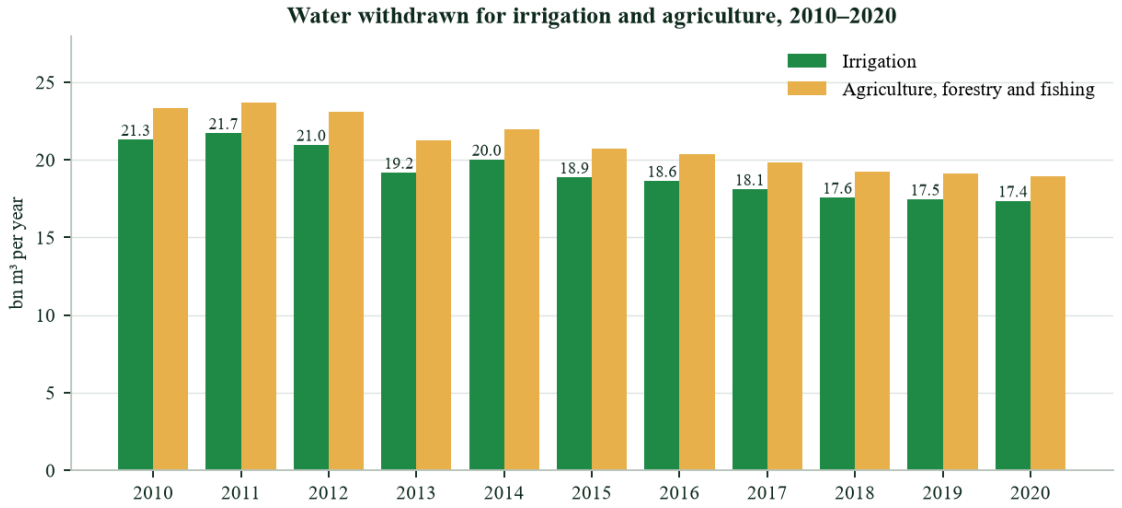
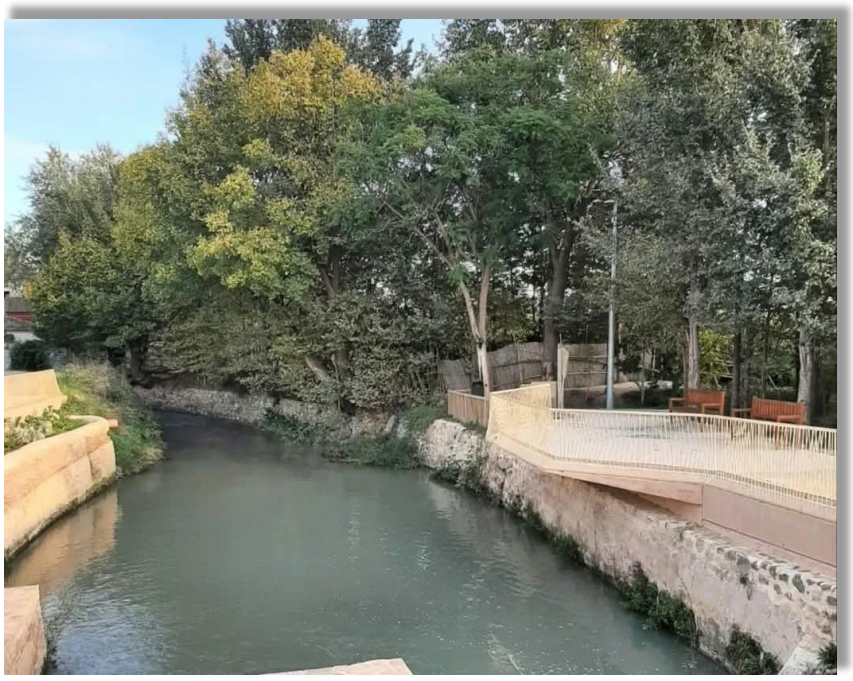


Figure 3. Water abstracted for irrigation and agriculture (billions of m³ per year). Source: Eurostat, env_wat_abs (A2), author's calculation.

4.2 Irrigated area and water per hectare

The 2023 agricultural census records 2.74 million hectares of irrigated land (A3). In 2020, water abstraction for irrigation amounted to 17,360 million m³. Relating this volume to the irrigated area gives **6,338 m³ per hectare per year**. This is a national average: It does not take account of crop type or region.



Irrigation channel (acequia), in Spain.



Apple orchard with tractor.

4.3 Water price

No official 2025 irrigation-water tariff was found in the documents consulted. The table brings together the available references, all at level C. The scenarios in section 8 use €0.10/m³ (cautious assumption), €0.22/m³ (central) and €0.45/m³ (high).

Water price references

Reference	Price (€/m³)	Context	Source (level)
Subsidised desalinated water, Comunidad Valenciana	0.22	State aid and regional discount of 10 cents (2023)	press (A18, C)
Aid ceiling provided for by Law 1/2018 (desalinated water)	0.30	Maximum price for subsidised irrigation	Agricultural press (C)
Desalinated water billed to irrigators	0.35 to 0.45	Price at the intake, July 2024	Agricultural press (C)
Price at the intake for desalinated water	0.45	Decree cited by the press; date to be confirmed	press (C)
Low assumption (cautious)	0.10	No source found: Assumption, not verified	assumption

Source: Annex A (A18); low assumption: Author's calculation.

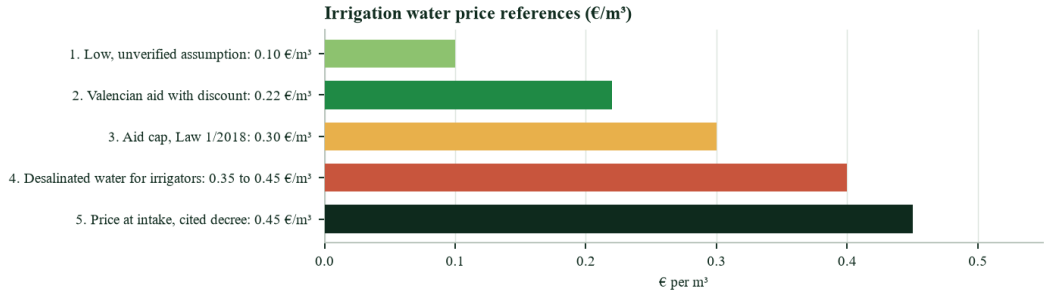


Figure 4. Irrigation-water price references (€/m³; midpoint of the range). Source: Previous table; Annex A (A18); author's calculation.

4.4 Public investment

Public investment in irrigation modernisation is channelled through the European recovery plan (PRTR). Two published projections do not match: This document presents both.

Investment in irrigation

Programme	Amount	Timetable	Source (level)
Irrigation modernisation, phase 1 (42 projects)	260 M€	agreement signed in June 2021	MAPA (A19, B)

Programme	Amount	Timetable	Source (level)
Irrigation modernisation, phase 2 (40 projects)	303 M€	agreement signed in July 2022	MAPA (A19, B)
Total public funding for modernisation	563 M€	2021 to 2027	MAPA (A19, B)
European funds through the agri-food PERTE	410 M€	recovery plan	press (A19, C)
Share borne by irrigators	up to 20% of the cost	—	MAPA (A19, B)
Five-year projection	more than €2.1 billion	five years	press (C), contradictory
Another ministry projection	310 M€	up to 2027	press (C), contradictory

Source: Annex A (A19); the two projections do not match.

4.5 Drought

In September 2023, **14.6% of the territory** was in an emergency situation and **27.4%** on water-shortage alert (A12). The 2023 cereal-growing season was severely affected (section 10).

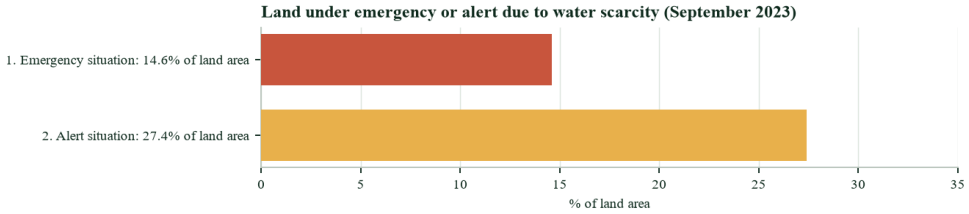


Figure 5. Proportion of Spanish territory in an emergency situation or on water-shortage alert (September 2023). Source: MITECO, press release of 12 September 2023 (A12, A).

5. Fertilisers: Quantities, prices, expenditure

5.1 Quantities used

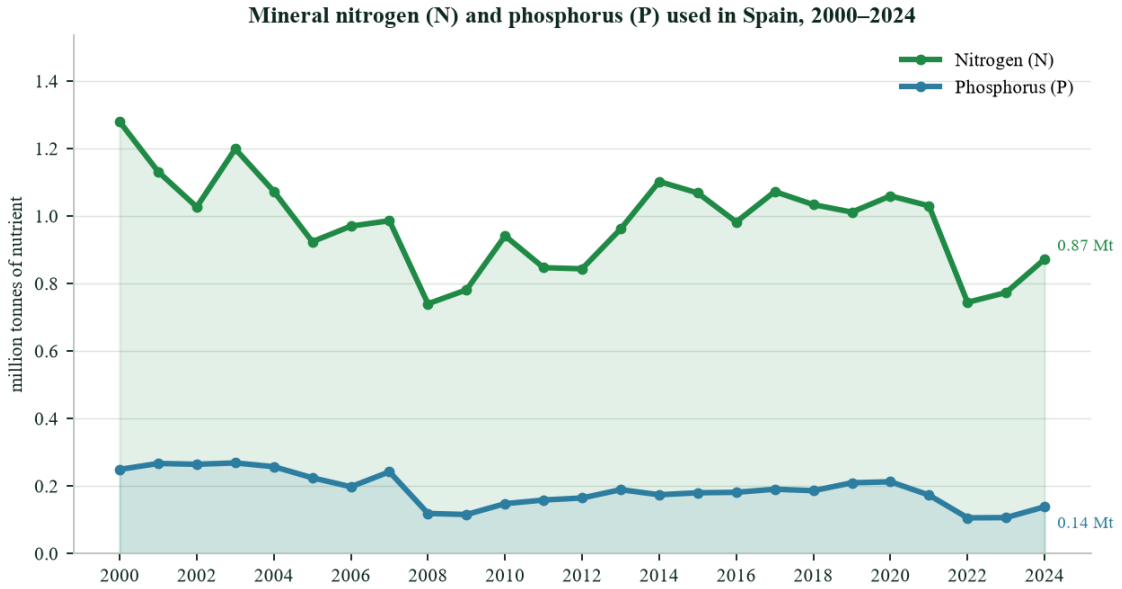


Figure 6. Mineral nitrogen (N) and phosphorus (P) used in Spain, 2000–2024 (million tonnes of nutrient). Source: Eurostat, aei_fm_usefert (A7). Eurostat publishes phosphorus in a unit that must be verified (P or P_2O_5).

Nitrogen and phosphorus used, in tonnes of nutrient

Year	Nitrogen (N)	Phosphorus (P)	Change in nitrogen
2020	1,059,299	212,467	4.8%
2021	1,029,913	173,028	-2.8%

Year	Nitrogen (N)	Phosphorus (P)	Change in nitrogen
2022	744,072	105,562	-27.8%
2023	773,011	106,287	3.9%
2024	871,886	138,305	12.8%

Source: Eurostat, aei_fm_usefert (A7).

5.2 Prices

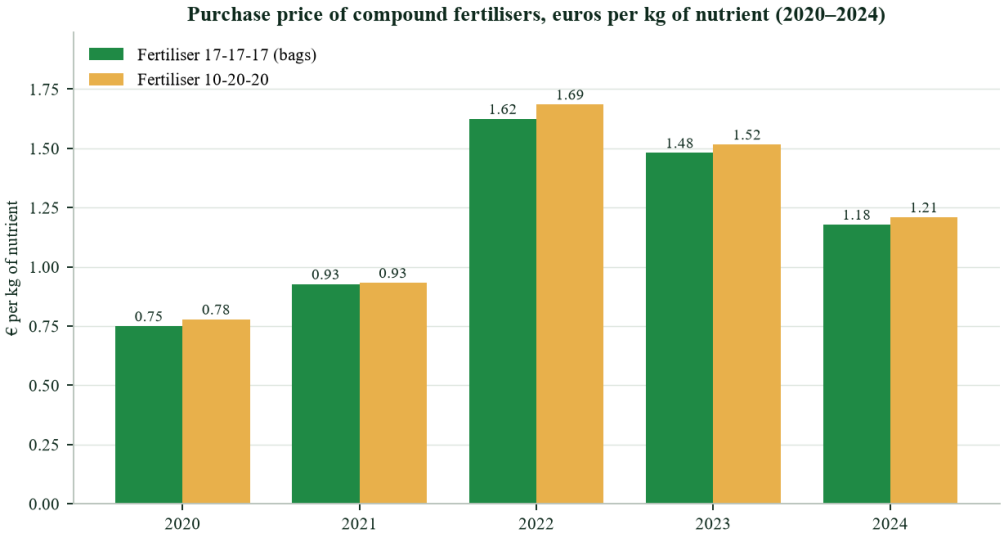


Figure 7. Purchase price of compound fertilisers, in euros per kilo of nutrient (2020–2024). Source: Eurostat, apri_ap_ina (A8), price per 100 kg of product divided by the sum of nutrient percentages; author's calculation.

Purchase price of compound fertilisers (€ per 100 kg of product)

Year	17-17-17	10-20-20
2020	38.25	38.95
2021	47.30	46.66
2022	82.87	84.29
2023	75.56	75.85
2024	60.14	60.50

Source: Eurostat, apri_ap_ina (A8).

5.3 Indicative expenditure

In 2022, nitrogen volumes fell by around 28% compared with 2021, while the price per kilo of nutrient more than doubled compared with 2020. Nevertheless, indicative expenditure reached its peak of €1.4 billion. In 2024, it fell to €1.2 billion. The ministry's official accounts would provide a more precise figure; they were not obtained for this work.



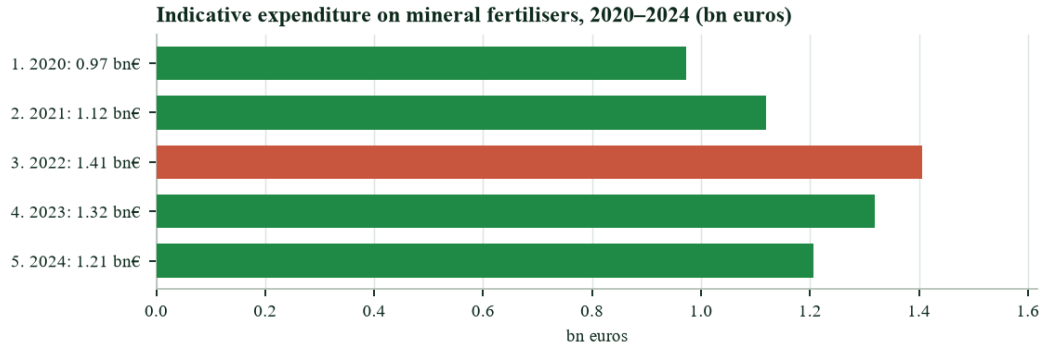


Figure 8. Indicative expenditure on mineral fertilisers (billions of euros per year). Source: Author's calculation based on A7 and A8 (method in Annex B). Estimate, not accounting data.

Limitations of the calculation

Expenditure is an order of magnitude: It applies an average price per kilo of nutrient to all nitrogen and phosphorus, and does not include potassium, which is absent from the Eurostat series used.

6. By autonomous community

The table compares Spain's 19 statistical regions (17 autonomous communities and two autonomous cities). Irrigated-area and production figures come from Eurostat (2023); exports are calculated from each community's share of the national total (A11).

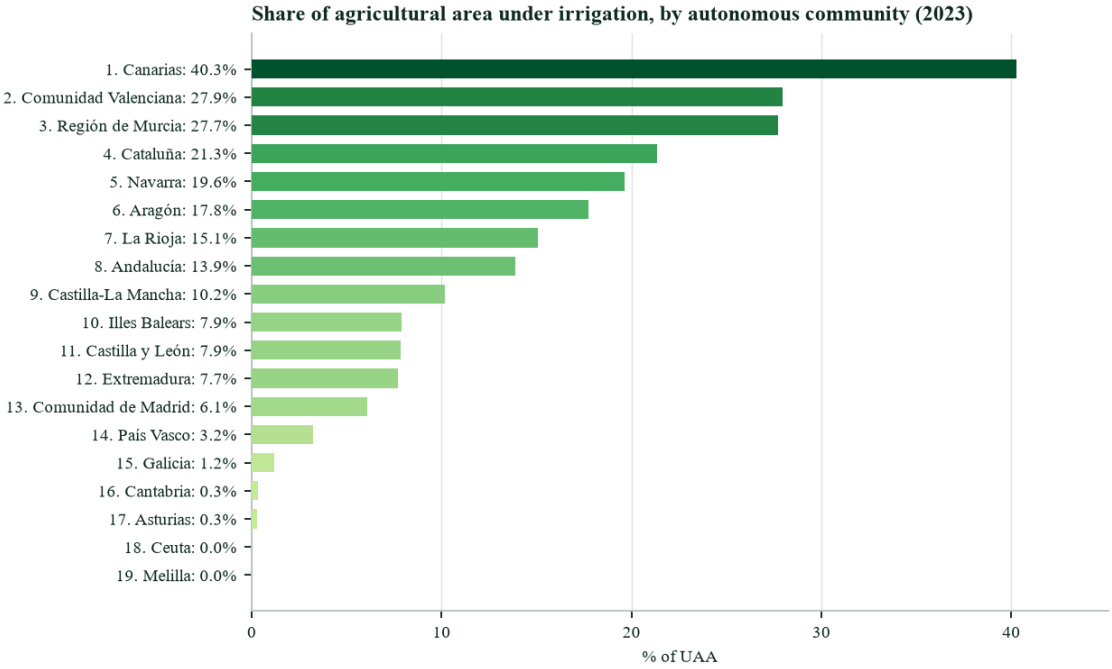


Figure 9. Share of agricultural area under irrigation, by community (2023). Source: Eurostat, ef_lus_irri and ef_lus_allcrops (A3, A4), author's calculation.

Figures by community

Community	Radiation (kWh/m²/year)	Irrigated area (ha)	Share under irrigation	Agricultural production 2023 (M€)	Exports 2024 (M€, approx.)	Water saved, central (Mm³/year)	Value generated, central (M€/year)
Andalucía	1,887	653,570	13.9%	15,346	16,220	421.5	116.4

Community	Radiation (kWh/m²/year)	Irrigated area (ha)	Share under irrigation	Agricultural production 2023 (M€)	Exports 2024 (M€, approx.)	Water saved, central (Mm³/year)	Value generated, central (M€/year)
Castilla-La Mancha	1,792	418,390	10.2%	6,241	3,755	294.8	73.5
Castilla y León	1,705	415,290	7.9%	7,787	3,529	344.8	134.7
Aragón	1,727	383,190	17.8%	7,214	3,905	252.5	68.6
Cataluña	1,664	224,990	21.3%	6,349	15,919	126.8	33.4
Extremadura	1,826	213,840	7.7%	3,386	1,802	162.3	41.2
Comunidad Valenciana	1,754	149,150	27.9%	4,258	9,311	81.9	18.1
Región de Murcia	1,800	96,910	27.7%	3,816	7,359	66.8	20.0
Navarra	1,512	93,100	19.6%	1,481	1,877	74.1	20.9
La Rioja	1,534	29,290	15.1%	714	901	16.8	5.0
Comunidad de Madrid	1,785	18,080	6.1%	417	2,703	15.1	4.2
Canarias	2,091	17,550	40.3%	925	300	13.5	7.1
Illes Balears	1,745	11,630	7.9%	240	300	7.8	4.7
Galicia	1,416	6,890	1.2%	5,140	4,505	2.3	0.6
País Vasco	1,386	5,700	3.2%	584	1,652	3.8	2.4
Asturias	1,267	970	0.3%	691	300	0.3	0.1
Cantabria	—	710	0.3%	509	375	0.2	0.1
Ceuta	1,788	0	0.0%	0	0	0.0	0.0
Melilla	1,822	0	0.0%	0	0	0.0	0.0

Source: Eurostat (A3, A4, A6); PVGIS (A10), value taken at the community capital; MAPA-Mercasa (A11); author's calculation (Annex B).

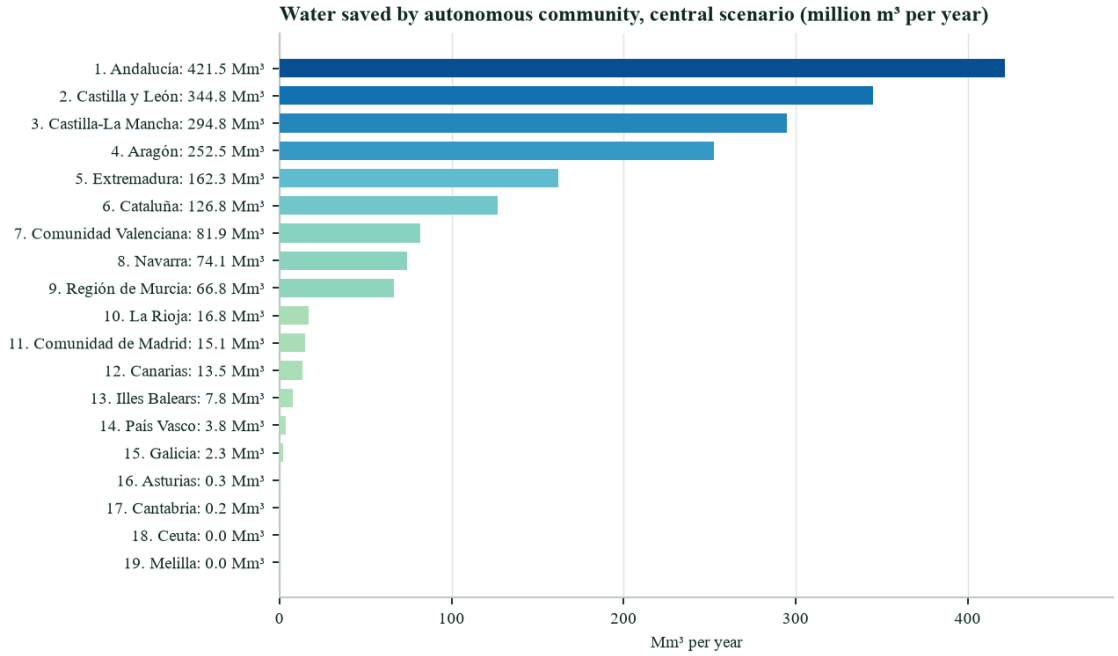


Figure 10. Water saved by community, central scenario (million m³ per year). Source: Author's calculation (Annex B), based on A3.

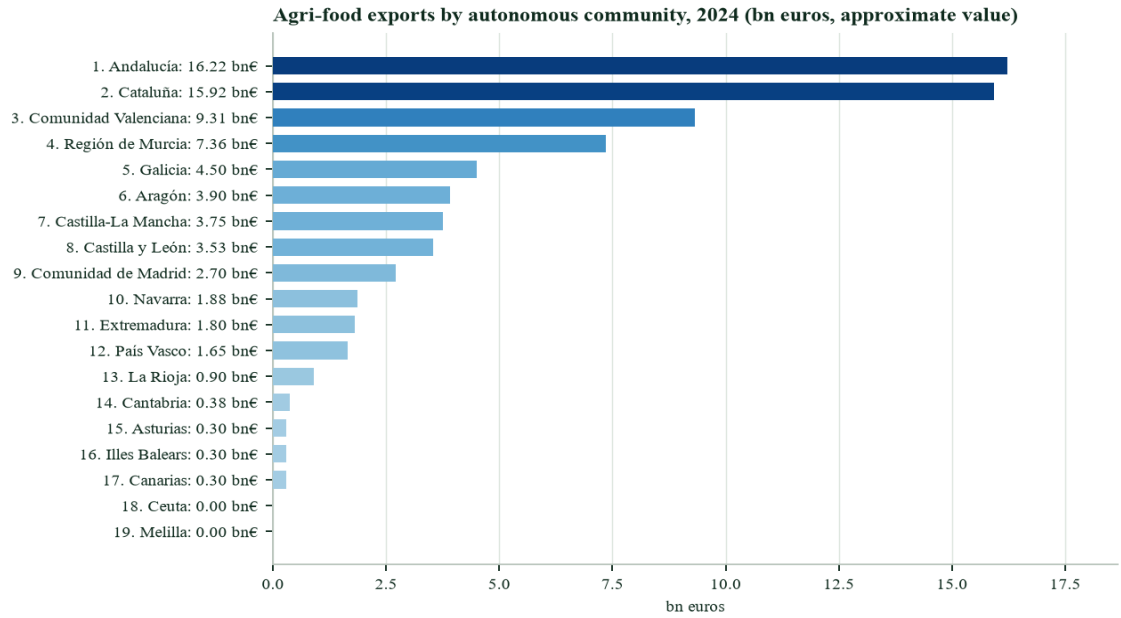


Figure 11. Agri-food exports by community, 2024 (billions of euros, approximate value). Source: MAPA-Mercasa (A11): each community's share × 75,091 M€; author's calculation.

Reading by community

• **Andalucía**: Leading community for irrigated land, with 653,570 ha; leading exporter (around €16 billion, 21.6% of the total).

• **Castilla-La Mancha, Castilla y León, Aragón**: 418,390, 415,290 and 383,190 ha of irrigated land (Eurostat), representing around 44% of national irrigated area.

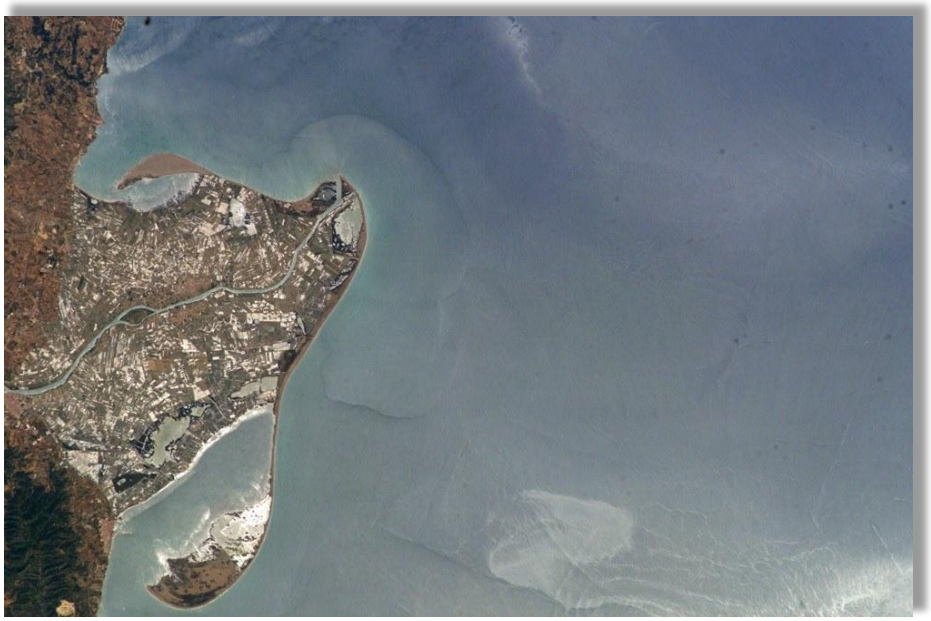
• **Comunidad Valenciana and Región de Murcia**: Very high share under irrigation (28% and 28% of UAA), and among the largest agri-food exporters (12.4% and 9.8% of the total).

• **Canarias**: The highest share under irrigation (40%), over a small UAA; high radiation (2,091 kWh/m² per year).

• **Galicia, Asturias, Cantabria, País Vasco**: Marginal irrigation; this is also the area where rainfall would decrease the most (section 3.3).



Greenhouses in Poniente almeriense (Almería), viewed from a satellite.



Ebro Delta (Cataluña), photographed from the International Space Station.

7. The top twenty crops: Three rankings

Crops are classified in three ways. The classification **by area** follows cultivated areas. The classification **by irrigated area** follows land that uses irrigation water. The classification **by production value** follows turnover. The years vary by table (2023 census for areas, 2024 crops for yields).



7.1 By area



Rows of open-field vegetables.

The twenty leading crops by area

Rank	Crop	Area (ha)	Irrigated area (ha)	Share under irrigation	Yield (t/ha)	Farm-gate price (€/t)	Year of area data
1	Barley	2,486,550	236,832	9.5%	3.2	202	2023
2	Olive trees	2,427,200	430,760	17.8%	—	—	2023
3	Common wheat and spelt	1,805,780	171,992	9.5%	3.7	218	2023
4	Green fodder	1,057,470	183,740	17.4%	—	—	2023
5	Dry pulses (peas, broad beans, lentils…)	851,690	90,390	10.6%	1.1	304	2023
6	Nuts (almonds, walnuts…)	819,550	241,837	29.5%	—	1,033	2023
7	Vineyards (grapes)	813,780	191,120	23.5%	—	501	2023
8	Sunflower	796,440	46,790	5.9%	1.1	415	2023
9	Oats and spring cereals	619,490	59,004	9.5%	2.2	216	2023
10	Durum wheat	295,020	28,099	9.5%	3.0	276	2023
11	Other cereals (triticale, sorghum…)	277,700	26,450	9.5%	2.5	202	2023
12	Grain maize	260,220	229,550	88.2%	12.3	226	2023
13	Citrus fruit	256,085	176,000	68.7%	—	290	2023
14	Fresh vegetables, melons and strawberries	251,380	79,630	31.7%	—	697	2023
15	Pome and stone fruit trees	232,860	68,713	29.5%	—	—	2023

Rank	Crop	Area (ha)	Irrigated area (ha)	Share under irrigation	Yield (t/ha)	Farm-gate price (€/t)	Year of area data
16	Rapeseed	98,440	18,970	19.3%	—	—	2024
17	Rice	85,940	51,860	60.3%	7.1	506	2024
18	Potatoes	61,390	25,770	42.0%	32.1	453	2024
19	Cotton	51,090	25,950	50.8%	—	—	2024
20	Sugar beet	45,690	25,280	55.3%	77.1	56	2024

Source: Eurostat, ef_lus_allcrops (A4) and apro_cpnhr (A5) for 2024 crops; farm-gate prices (A9). Prices: 2024 averages.

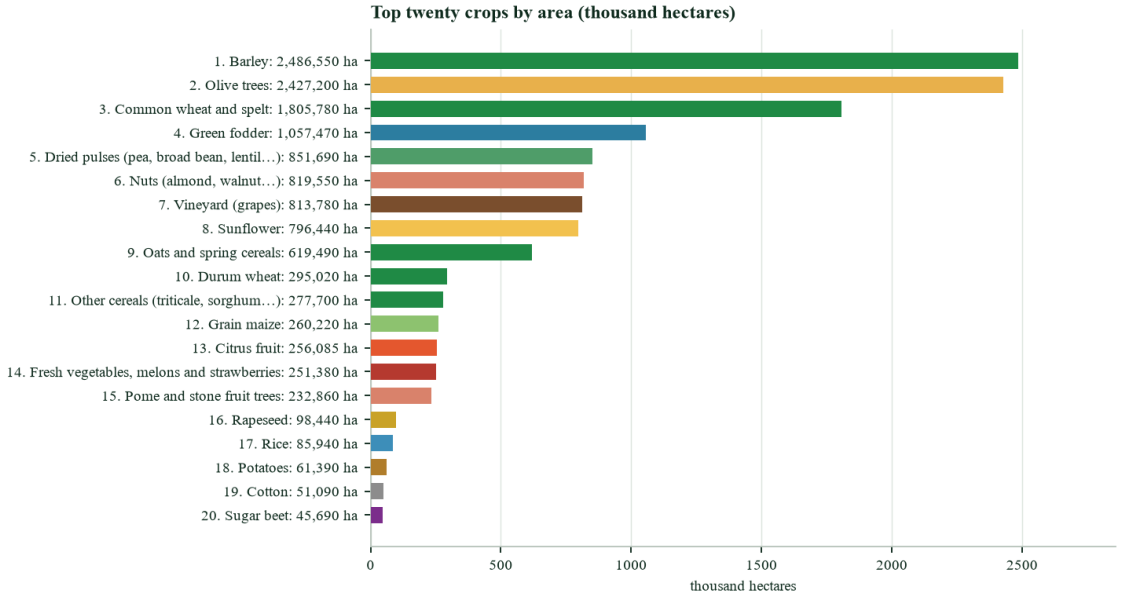


Figure 12. Area of the twenty leading crops (thousand hectares). Source: Eurostat (A4, A5), author's calculation.

7.2 By irrigated area

Irrigated area by crop category (2023)

Rank	Category	Irrigated area (ha)	Share of total irrigated area
1	Cereals (excluding rice and maize)	534,800	19.5%
2	Olive groves	430,760	15.7%
3	Fruit trees, berries and nuts (excluding citrus fruit, grapes and strawberries)	310,550	11.3%
4	Grain maize	229,550	8.4%
5	Vineyards (grapes)	191,120	7.0%
6	Green-harvested plants (fodder)	183,740	6.7%
7	Citrus fruit	176,000	6.4%
8	Other arable crops	160,220	5.8%
9	Dry pulses and protein crops	90,390	3.3%
10	Fresh vegetables, melons and strawberries (open field)	79,630	2.9%
11	Rice	51,860	1.9%
12	Sunflower	46,790	1.7%
13	Textile plants (cotton)	25,950	0.9%
14	Potatoes	25,770	0.9%
15	Sugar beet	25,280	0.9%
16	Rapeseed and turnip rape	18,970	0.7%

Source: Eurostat, ef_lus_irri (A3). Sixteen published categories; "other arable crops" not broken down by Eurostat.

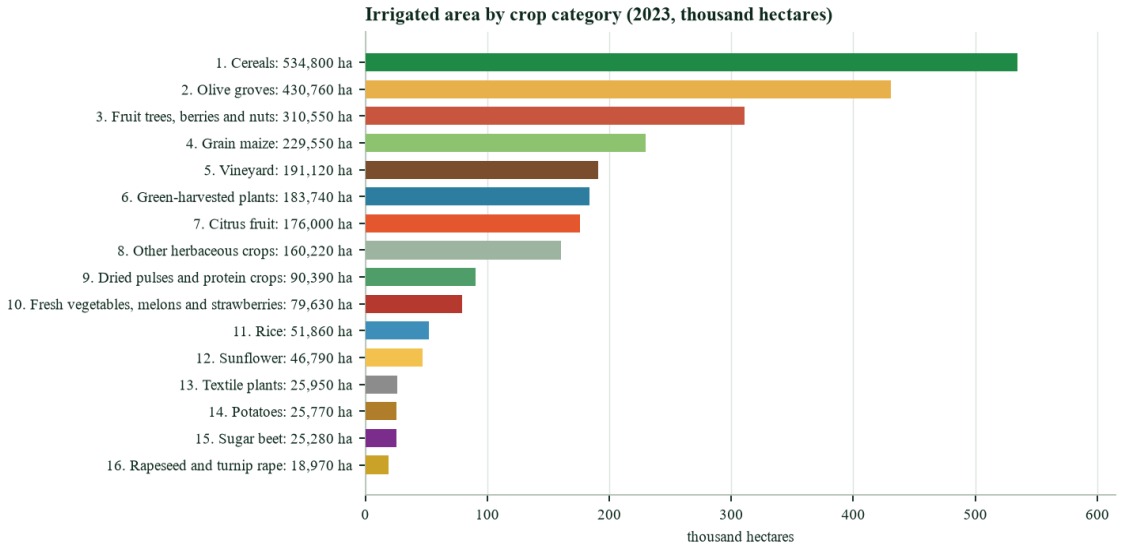


Figure 13. Irrigated area by crop category (2023, thousand hectares). Source: Eurostat, ef_lus_irri (A3).

7.3 By production value

Production value by product (2023, farm-gate price)

Rank	Product	Value (million euros)
1	Fresh vegetables (incl. melons)	9,233
2	Plants and flowers	4,188
3	Fresh fruit (excluding citrus fruit, olives and grapes)	3,842
4	Olives	3,076
5	Fodder crops	3,060
6	Cereals (incl. seeds)	2,847
7	Citrus fruit	2,784
8	Grapes	1,290
9	Potatoes	870
10	Subtropical fruit	570
11	Sunflower	332
12	Sweetcorn	309
13	Other industrial crops	270
14	Sugar beet	173

Source: Eurostat, aact_eaa01_r (A6). Fourteen non-overlapping products; cereals are grouped together.



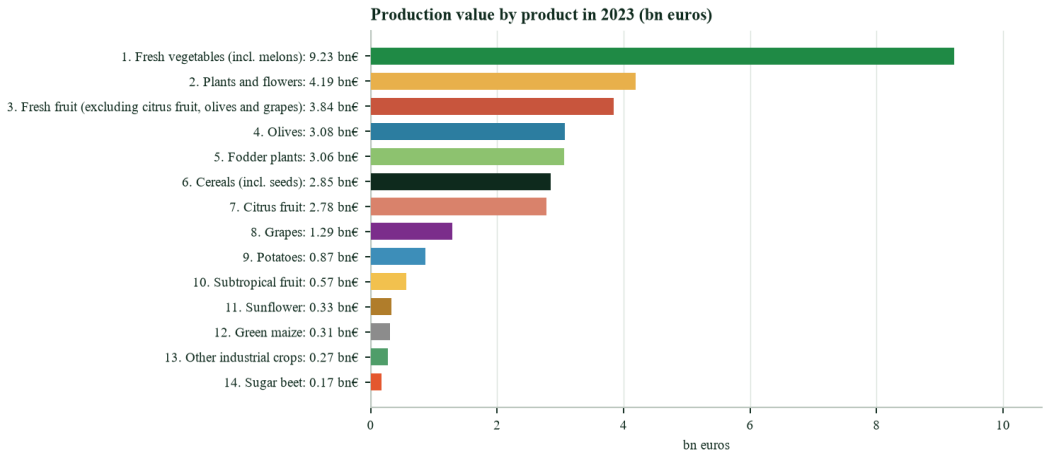


Figure 14. Production value by product in 2023 (bn€). Source: Eurostat, aact_eaa01_r (A6).

Vegetables, fruit and olives account for more in value than in area. Cereals dominate in area, but their production value is lower than that of vegetables or fruit. This difference explains the interest in our products: The same water saved does not have the same value depending on the crop.





Freshly harvested rainbow chard.

8. Extrapolation by crop and water savings

8.1 Method

Method in brief

• **Irrigated area** of each crop: Its area, multiplied by the irrigated share of its group; the share is taken from Eurostat (A3, A4).

• **Water per irrigated hectare**: 6,338 m³ national average (2020 withdrawals divided by the 2023 area).

• **Water savings and yield increase**: Taken from the cited trials (section 8.2), at 25% (cautious), 50% (central) and 100% (high) of the measured effect.

• **Crops without a trial**: Generic water savings of 5%, 10% and 20%, with no yield increase. Rice is not assessed (flood irrigation).

• **Value generated**: Water saved × water price, plus yield increase × 2024 farm-gate price (A9).

• **Product price**: This document does not calculate it; the values presented are those of water saved and yield.

8.2 Trials used as analogues

Cited trials and their use in the calculation

Trial	Published water saving	Published yield increase	Use in the document	Level
Maize, Türkiye (TIGEM, Konya), 2025	−38.9%	+17.1%	Grain maize; cotton (analogy)	C (A22)
Potato, South Africa, 2025	−52%	+31.4%	Potatoes	C (A23)
Watermelon, Mexico (Sonora), 2023	−60.5%	+30%	Vegetables, melons, strawberries	C (A24)
Date palm, United Arab Emirates (ICBA), 2021–2022	−82% (85% stabilised in 7 months)	+20%	Not used: There is no equivalent crop in Spain	B (A25)

Trial	Published water saving	Published yield increase	Use in the document	Level
Soybean, China (Shandong), superabsorbent polymer	Not published	+11.2 to +11.4%	Cereals, pulses, sunflower, rapeseed (weak analogy)	B (A26)
Sugar cane, Java (Jember), 2024	Not published	Tonnage +34 to +55%	Not used: Sugar cane is not grown in Spain	B (A27)
Cotton, Türkiye (Hatay), demonstration	Not published	+93%	Not used: A single site; cotton follows maize	C (A28)

Source: Documents published on the Green Solutions website; ICBA (A25); Annex A.

8.3 Parameters by crop group

Water savings and yield increases adopted, by scenario

Group	Analogue	Water (cautious / central / high)	Yield (cautious / central / high)
Cereals (barley, wheat, oats, triticale…)	Generic; yield: Soybean	5% / 10% / 20%	2.8% / 5.7% / 11.3%
Grain maize	Maize, Türkiye	9.8% / 19.5% / 39%	4.3% / 8.6% / 17.1%
Vegetables, melons, strawberries	Watermelon, Mexico	15.1% / 30.3% / 60.5%	7.5% / 15% / 30%
Potatoes	Potato, South Africa	13% / 26% / 52%	7.9% / 15.7% / 31.4%
Dry pulses, sunflower, rapeseed	Generic; yield: Soybean	5% / 10% / 20%	2.8% / 5.7% / 11.3%
Cotton	Maize (analogy)	9.8% / 19.5% / 39%	4.3% / 8.6% / 17.1%
Olive groves, vineyards, citrus orchards, fruit trees, beet, forage crops, other	Generic	5% / 10% / 20%	0%
Rice	Not assessed (flooding)	0	0

Source: Author's calculation; analogues from section 8.2.

8.4 National results

943 Mm³
of water saved per year in the cautious scenario, i.e. 276 M€ per year at 0.22 €/m³.

1,885 Mm³
of water saved per year in the central scenario, i.e. 551 M€ per year at 0.22 €/m³.

3,770 Mm³
of water saved per year in the high scenario, i.e. 1,102 M€ per year at 0.22 €/m³.

Water savings and annual value, by water saving and water price

Scenario	Water saved (Mm³/year)	Value at 0.10 €/m³ (M€/year)	Value at 0.22 €/m³ (M€/year)	Value at 0.45 €/m³ (M€/year)
Cautious	943	162	276	492
Central	1,885	325	551	984
High	3,770	649	1,102	1,969

Source: Author's calculation; values include the yield increase, at the 2024 farm-gate price.



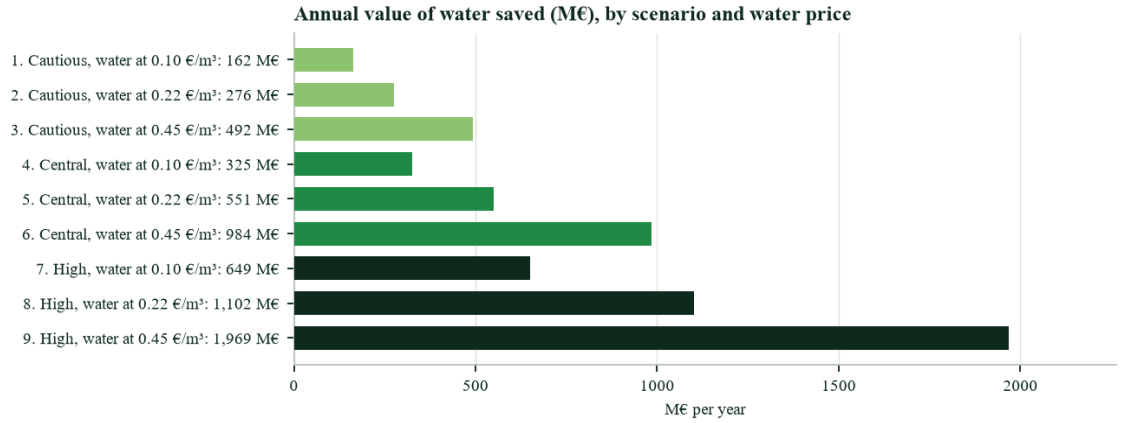


Figure 15. Annual value of water saved (M€), by scenario and water price. Source: Author's calculation (Annex B).

8.5 Water saved by crop (central scenario)

Irrigated area and water saved by crop (central scenario)

Crop	Irrigated area (ha)	Water saved (Mm³/year)	Analogue
Grain maize	229,550	283.7	Maize, Türkiye
Olive trees	430,760	273.0	Generic
Nuts (almonds, walnuts…)	241,837	153.3	Generic
Fresh vegetables, melons and strawberries	79,630	152.7	Watermelon, Mexico
Barley	236,832	150.1	Generic (yield: Soybean)
Vineyards (grapes)	191,120	121.1	Generic
Green fodder	183,740	116.4	Generic
Citrus fruit	176,000	111.5	Generic
Common wheat and spelt	171,992	109.0	Generic (yield: Soybean)
Dry pulses (peas, broad beans, lentils…)	90,390	57.3	Generic (yield: Soybean)
Pome and stone fruit trees	68,713	43.5	Generic
Potatoes	25,770	42.5	Potato, South Africa
Oats and spring cereals	59,004	37.4	Generic (yield: Soybean)
Cotton	25,950	32.1	Maize (analogy)
Sunflower	46,790	29.7	Generic (yield: Soybean)
Durum wheat	28,099	17.8	Generic (yield: Soybean)
Other cereals (triticale, sorghum…)	26,450	16.8	Generic (yield: Soybean)
Sugar beet	25,280	16.0	Generic
Rapeseed	18,970	12.0	Generic (yield: Soybean)
Rice	51,860	0.0	Not assessed

Source: Author's calculation (Annex B).



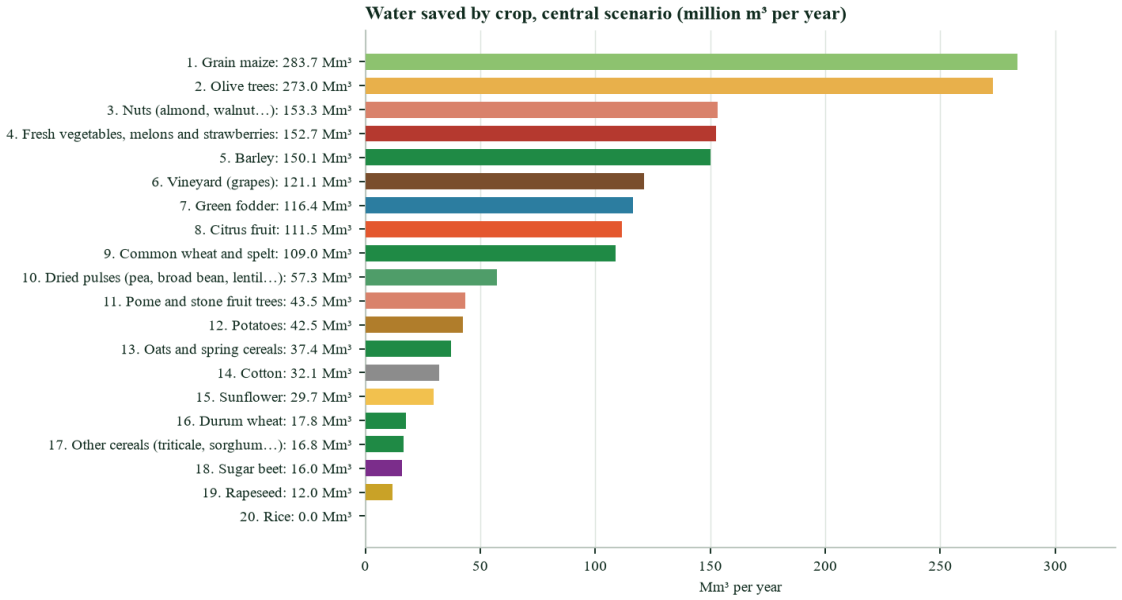


Figure 16. Water saved by crop (million m³ per year, central scenario). Source: Author's calculation (Annex B).

8.6 Reading the results

Key points

• **Water saved depends on the crop and its irrigated area.** The table and figure show how much water corresponds to each crop in the central scenario.

• **The results for maize, vegetables and potatoes are based on one or two trials.** They must be confirmed in Spain before being used as a reference.

• These results do not take account of labour, application or product price, which this document does not calculate.

9. Potential benefits of our products

The table sets out what the products can contribute according to the available documents, with their confidence level and limitation. It does not include published figures that are not linked to an identified trial.

Benefits, evidence and limitations

Benefit	What is published	Source (level)	Limitation
Irrigation water savings	Maize −38.9%; potato −52%; watermelon −60.5%; date palm −82%	A22 to A25 (C, B)	One trial per crop; conditions not comparable with Spain
Yield	Maize +17.1%; potato +31.4%; watermelon +30%; date palm +20%; soybean +11.2 to +11.4%	A22 to A26 (B, C)	One or two trials per crop; controls sometimes differ
Moisture retention during dry weeks	Date palm: Irrigation was reduced from once a day to once every seven days, with no visible damage	A32 (C), citing ICBA (A25)	No measurement in Spanish soil
Safety: Acrylamide	ECOSORB®: Acrylamide below 3.0 µg/g, the method's limit of quantification	A29 (B)	One laboratory, one date
REACH compliance	EVERGREEN®: Substances of very high concern ≤ 0.1% in 233 substances tested	A30 (B)	Screening, not approval
Organic certification	ECOFERT® certified by SOHISCERT and EU Bio	A31 (A)	Valid only for the certified product
Use in countries	ECOFERT® used in 60 countries (website)	A32 (C)	Declared figure
Agroforestry	Paulownia ALTIFOLIA®: 13 to 15 m in 6 to 8 years; timber around 550 €/m³ (website)	A32 (C)	No trial in Spain

Source: Annex A (A22 to A32).



Growing tunnel and neighbouring plots.

What this document does not take into account

• Published water-saving figures for the product range as a whole (very wide ranges) are not included: No identified trial documents them.

• The +93% from the cotton demonstration (a single site) and the sugar-cane tonnage increases (there is no sugar cane in Spain) are presented, but not used in the scenarios.

• Water Vital® and NAPEMA® are not addressed: No independent source was found in the documents consulted.

10. Foreign trade: Exports and imports

10.1 Overview, 2024

Spain's agri-food trade, 2024

Indicator	Value	Change 2023–2024
Agri-food exports	75,091 M€	+5.8%
Agri-food imports	55,859 M€	+1.4%
Trade balance	19,232 M€	+21.2%
Share of agri-food in total exports	19.5%	—
Share of exports to the European Union	66.3% (49,772 M€)	+4.1%

Indicator	Value	Change 2023–2024
Top destination: France	11,496 M€	+2.3%
Second destination: Germany	8,474 M€	+1.8%
Top destination outside the EU: United Kingdom	5,127 M€	+3.3%
Fast-growing destination outside the EU: United States	3,609 M€	+21.4%

Source: MAPA-Mercasa, Food in Spain 2025, DATACOMEX data (A11).

10.2 Exports

Exports of water-sensitive products, 2024

Product	2024 value (M€)	2024 volume (kt)	2023 value (M€)
Olive oil	6,155.1	778.9	4,166.8
Pork	8,784.6	2,724.5	—
Wine and must	3,046.7	2,041.5	2,997.8
Peppers	1,564.7	804.1	1,518.4
Mandarins	1,487.0	1,137.4	1,477.6
Oranges	1,154.8	1,208.0	1,203.3
Fresh tomatoes	1,099.5	674.4	1,172.6
Strawberries	788.5	255.3	700.3
Watermelons	552.7	789.7	498.2

Source: MAPA-Mercasa, DATACOMEX (A11).



Small fruit: Raspberries, currants, blueberries, blackberries.

Fruit exports (6.95 Mt) and vegetable exports (6.56 Mt) in 2024 come mainly from the south and east. Región de Murcia and Comunidad Valenciana (9.8% and 12.4% of agri-food exports) have an irrigated share of around 28% of their UAA (Eurostat).



Yellow courgettes (pattypan type) in a box.

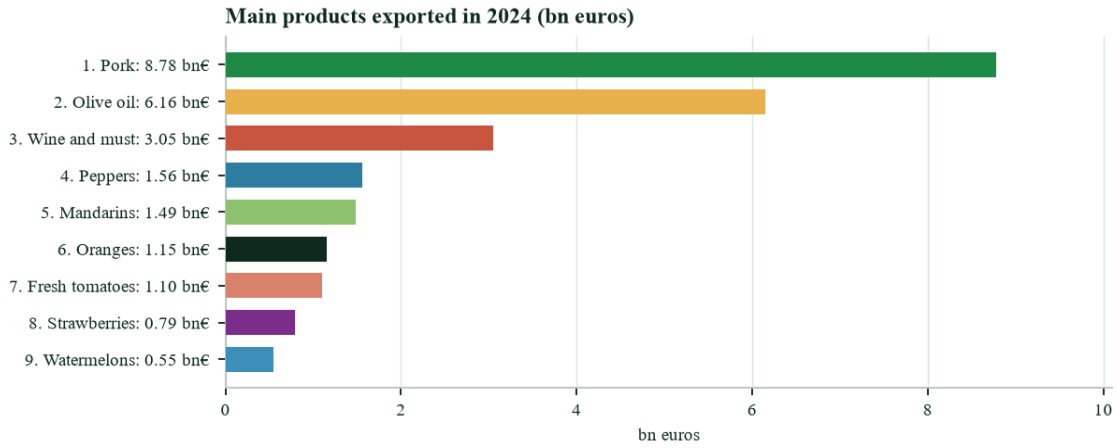


Figure 17. Main products exported in 2024 (billions of euros). Source: MAPA-Mercasa, DATACOMEX (A11).

10.3 Imports

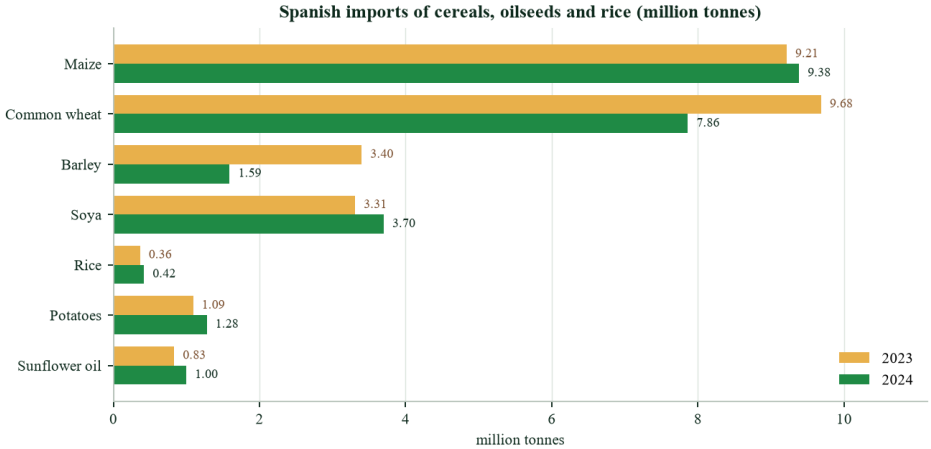


Figure 18. Spanish imports of cereals, oilseeds and rice (million tonnes, 2023 and 2024). Source: MAPA-Mercasa, DATACOMEX (A11).

Imports of cereals and irrigated crops, 2023 and 2024

Product	Volume 2023 (kt)	2024 volume (kt)	2024 value (M€)
Maize	9,212.6	9,382.6	2,050.7
Soft wheat	9,684.5	7,861.0	1,793.9

Product	Volume 2023 (kt)	2024 volume (kt)	2024 value (M€)
Barley	3,398.0	1,591.1	342.3
Soya	3,308.0	3,699.0	1,588.0
Rice	364.6	418.4	307.8
Potatoes	1,091.1	1,277.8	561.3
Sunflower oil	831.2	996.8	964.9

Source: MAPA-Mercasa, DATACOMEX (A11).

10.4 Water and imports

The vast majority of maize is irrigated. In 2023, 88% of the area under grain maize was irrigated (Eurostat). However, Spain imports 9.4 Mt of maize, compared with 3.5 Mt produced within its territory. The water used to produce that imported maize is therefore not included in Spanish abstractions: it is water consumed abroad.

This calculation of **virtual water** is not quantified here: It would be necessary to know the yields and practices of supplier countries, which are not included in the sources consulted.

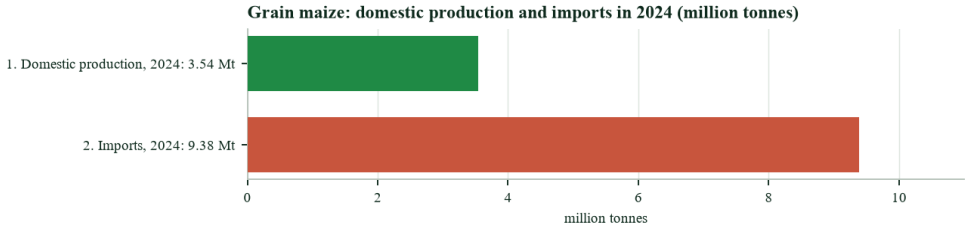


Figure 19. Grain maize: Domestic production and imports in 2024 (million tonnes). Source: Eurostat, apro_cpnhr (A5); MAPA-Mercasa (A11); irrigation share: Eurostat, ef_lus_irri and ef_lus_allcrops (A3, A4).

10.5 Drought and the 2023 season

The 2023 cereal season was severely affected. According to statistics cited by the press (A20, level C), cereal production fell by 38% compared with 2022, barley production by 44% and oat production by 45%. An official estimate from September 2023 put cereal imports needed to meet demand at around 20 million tonnes (B, to be confirmed).

Barley imports fell from 3.4 Mt in 2023 to 1.6 Mt in 2024; wheat imports fell from 9.7 Mt to 7.9 Mt. The 2023 peak coincides with a very poor harvest. The lack of water is therefore reflected in purchases from abroad.

The cost of irrigation water is not quantified in trade: in the absence of a regional price series, this link remains qualitative.

11. Limitations and outstanding issues

Items still to be completed

• **Rainfall by autonomous community.** The AEMET 1991–2020 normals have not been obtained. The relevant official sources (MAPA and INE) were inaccessible to the working team because no validated certificate was available; verification has not been bypassed. This point must be completed before any submission.

• **Regional projections.** No quantified regional figure has been found in readable sources. The projections cited are national or come from the press (level C).

• **Official water and fertiliser data by autonomous community.** Regional irrigation volumes (INE) and official fertiliser accounts (MAPA) have not been obtained. Fertiliser expenditure is therefore estimated.

• **Trials.** One or two trials per crop, none in Spain, and demonstrations are rarely independent. No peer-reviewed study of the products has been identified.

• **Water price.** No official 2025 irrigation water tariff has been found; the low value is an assumption.

• **Potatoes, maize and vegetables.** Its results depend on one or two trials: They must be confirmed by a trial in Spain.

• **Woody crops.** For olive groves, vineyards, citrus orchards and fruit trees, the sources do not publish any yield improvement: only water savings are calculated.

• **Years.** Areas are taken from the 2023 censuses and crops from 2024; prices and production value are from 2023–2024. Figures from the press must be checked before any publication.

Annex A. Sources and confidence levels

List of sources

Ref.	Source	Publisher or author	Year	Level	Link or reference
A1	Development indicators, Spain series	World Bank (WDI API)	2022–2025	A	data.worldbank.org/country/spain
A2	Water abstraction by sector (env_wat_abs)	Eurostat	2010–2020	A	ec.europa.eu/eurostat (table env_wat_abs)
A3	Irrigated crops by autonomous community (ef_lus_irri)	Eurostat, agricultural census	2023	A	ec.europa.eu/eurostat (table ef_lus_irri)
A4	Areas of all crops by autonomous community (ef_lus_allcrops)	Eurostat	2023	A	ec.europa.eu/eurostat (table ef_lus_allcrops)
A5	Annual crops by autonomous community (apro_cpnhr)	Eurostat	2020–2024	A	ec.europa.eu/eurostat (table apro_cpnhr)
A6	Agricultural accounts by autonomous community (aact_eaa01_r)	Eurostat	2020–2023	A	ec.europa.eu/eurostat (table aact_eaa01_r)
A7	Mineral fertilisers, consumption (aei_fm_usefert)	Eurostat	2000–2024	A	ec.europa.eu/eurostat (table aei_fm_usefert)
A8	Purchase prices of production inputs (apri_ap_ina)	Eurostat	2000–2024	A	ec.europa.eu/eurostat (table apri_ap_ina)
A9	Farm-gate prices for crops (apri_ap_crpouta)	Eurostat	2000–2024	A	ec.europa.eu/eurostat (table apri_ap_crpouta)
A10	Horizontal solar radiation (PVGIS, MRcalc)	European Commission, JRC	2005–2020	A	re.jrc.ec.europa.eu/pvg tools
A11	Agri-food trade 2024 (Food in Spain 2025, DATACOMEX)	Mercasa, MAPA	2024	A	mercasa.es (AEE 2025, foreign trade)
A12	Statement on water scarcity (14.6% emergency, 27.4% alert)	MITECO	Sept. 2023	A	miteco.gob.es, press, 12/09/2023
A13	Rainfall annex of the Observatorio Nacional de la Sequía	MITECO	2024–2025	B	miteco.gob.es (rainfall annex)
A14	Observed trends and projections (chapter 2)	AEMET, MITECO	n.d.	B	miteco.gob.es (ch. 2, trends and projections)
A15	Flows, A2 scenario (CEDEX study 2010, cited)	CEDEX, cited by Ecologistas en Acción	2010 (cited in 2019)	B	ecologistasenaccion.org (report on water and climate, 2019)
A16	Rainfall by 2050 (UPC study cited by the press)	UPC, El Español	Jan. 2025	C	Full reference to be completed
A17	Rainfall by 2050 (report cited by the press)	Observatorio de la Sostenibilidad	n.d.	C	Full reference to be completed
A18	Aid for desalinated water, Comunidad Valenciana	Alicante Plaza, agricultural press	2023–2024	C	alicanteplaza.es (aid for desalinated water)
A19	Modernisation of irrigation (PRTR), amounts and phases	MAPA	2021–2022	B	mapa.gob.es (statement of July 2021)
A20	2023 cereal harvest	La Política Online, Agronews, cited statistics	2023–2024	C	lapoliticaonline.com (climate crisis, cereals)
A21	Agricultural income 2021: Intermediate consumption	MAPA	2021–2022	B	mapa.gob.es (agricultural income 2021)
A22	Maize trial, Turkey (TIGEM, Konya)	Green Solutions and Turkish partner (website)	2025	C	Document published on the website
A23	Potato trial, South Africa	Green Solutions (website)	2025	C	Document published on the website
A24	Watermelon trial, Mexico (Sonora)	Green Solutions (website)	2023	C	Document published on the website

Ref.	Source	Publisher or author	Year	Level	Link or reference
A25	Date palm and hydrogel, United Arab Emirates	ICBA (International Center for Biosaline Agriculture)	Nov. 2022	B	Final project report (published on the website)
A26	Soya and superabsorbent polymer, China	Shandong Institute, Summit Enterprise (website)	n.d.	B	Trial report (published on the website)
A27	Sugar cane, Java	University of Jember (website)	Sept. 2024	B	Trial report (published on the website)
A28	Cotton, Türkiye (Hatay), demonstration	Green Solutions (website)	n.d.	C	Document published on the website
	Acrylamide analysis, ECOSORB®	Polymex Laboratory (website)	2024	B	Analysis report (published on the website)
A29	REACH/SVHC screening, EVERGREEN®	SGS (website)	2023	B	Screening report (published on the website)
A30	ECOFERT® certificate	Certification body (website)	Valid	A	Certificate published on the website
A31	Declared performance, dosage and uses	Green Solutions	2026	C	Website and strategic document (published)
A32	Calculations in this document	Document author	n.d.	—	Annex B

Annex B. Calculation method

Radiation. Sum of the monthly horizontal radiation values from PVGIS (192 values), divided by the number of years (16). Capital of each autonomous community.

Water per hectare of irrigated land. 2020 irrigation abstractions (17,360 million m³) ÷ irrigated area in 2023 (2,739,250 ha) = 6,338 m³/ha.

Irrigated area of a crop. Crop area × irrigated share of its group (irrigated area of the group ÷ area of the group, Eurostat).

Water saved. Irrigated area × water per hectare × water saving under the scenario.

Yield increase. Irrigated area × yield (t/ha, Eurostat 2024) × yield increase under the scenario.

Value generated. Water saved × water price (0.10; 0.22 or 0.45 €/m³) + yield increase × 2024 farm-gate price (€/t).

Product price. Not calculated in this document: The values presented are those for water saved and yield.

Scenarios. Prudent: 25% of the trial effect. Central: 50%. High: Published effect. Crops without a trial: 5%, 10% and 20% water saving, with no yield increase.

Fertiliser expenditure. (Tonnes of nitrogen + tonnes of phosphorus) × average price per kilogram of nutrient (17-17-17 and 10-20-20). The price per kilogram of nutrient is the price per 100 kg of product divided by the sum of nutrient percentages (51 for 17-17-17, 50 for 10-20-20).

Regional exports. Share of each autonomous community in 2024 exports (A11) × 75,091 M€. Approximate values.

General limitations. National averages for water per hectare; a single coefficient per crop group; 2024 farm-gate prices applied to all years; no product cost is included in the calculations in this document.

Scope of the calculations. The calculations cover the 2.58 million hectares broken down by crop by Eurostat (sixteen categories). The remaining 0.16 million hectares of irrigated land, not broken down, are excluded: total water savings are therefore underestimated by the same proportion.



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