

COUNTRY DOSSIER

Chile

Water, climate, fertilisers and crops: National study and a study of each region, potential benefits of our products, external trade

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Vines in the Andean foothills, central Chile.

Foreword

This dossier describes Chile from the angle of water, climate, fertilisers and crops. It is written for the ministries in charge of agriculture, water and trade, the regional directorates of agriculture, cooperatives and producer organisations. It answers three questions: Where is water in short supply? For which crops? In which regions? It then examines what difference our products can make, in rainfed as well as irrigated farming, and what that can mean for the country's external trade.

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

How to read this document

- **A**: Official statistics or international database (World Bank, FAO, Chilean public bodies (INE, ODEPA, SAG, National Irrigation Commission)).
- **B**: Research institute, laboratory, United Nations agency or recognised climate model.
- **C**: Manufacturer statement, website, press or estimate.
- "M" means million; "Mm³" means million cubic metres; "t" means tonnes; "I$" means constant 2014-2016 international dollars.
- A "scenario" is a calculation based on the trials cited. It is not a measurement made in Chile.

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Summary

The points below summarise the dossier. The figures come from public sources: The World Bank, FAO (FAOSTAT, AQUASTAT), Chilean public bodies (INE, ODEPA, SAG, National Irrigation Commission), PVGIS and NASA POWER. The production gains and water savings are scenarios, described in Annex B.

19.86 M
Inhabitants in 2025 (World Bank)

198,067 ha
Of wheat harvested in 2024, the main crop

1.11 M ha
Equipped for irrigation (2024)

3,989 Mm³
Of irrigation water saved a year, central scenario

14,633 M$
Of agricultural exports in 2024 (FAOSTAT)

Key points

• **Irrigation, a pillar of production.** 1.11 million hectares equipped for irrigation in 2024, or 58% of the 1.91 million hectares of cropland.

• **Wheat: The main crop.** 198,067 ha harvested in 2024, for 1.19 million tonnes, or 6.00 t/ha.

• **Water is not scarce over the year as a whole; it is scarce between rainfall events.** National water stress is only 9.0%, but at Iquique, atmospheric water demand exceeds rainfall by 1,452 mm.

• **In irrigated farming, the water saved could allow irrigation schemes to be expanded.** 3,989.1 Mm³ a year in the central scenario, enough to irrigate about 137,571 more ha, or 12.4% of the equipped area.

• **An organic supply chain.** 19,380 ha of certified organic cropland in 2024: ECOFERT® is EU Bio certified.

• **Fertilisers made locally.** 240,960 t of nitrogen used in 2024; the country produces 46,722 t and imports 329,761 t.

• **Farm trade.** $14,633 million of exports and $9,802 million of imports in 2024. Leading export: Cherries ($3,264 million). Leading import: Boneless beef, fresh or chilled ($1,471 million).

Key figures

Key indicators for Chile

Indicator	Value	Year	Source (level)
Population	19.86 M	2025	World Bank (A1)
GDP per capita	17,995 $	2025	World Bank (A1)
Agriculture's share of GDP	3.5%	2025	World Bank (A1)
Agricultural employment	6.1%	2025	World Bank (A1)
Cropland	1,908,900 ha	2024	FAOSTAT (A6)
Area equipped for irrigation	1,108,560 ha	2024	FAOSTAT (A6)
Harvested area: Wheat	198,067 ha	2024	FAOSTAT (A2)
Certified organic cropland	19,380 ha	2024	FAOSTAT (A6)
Agricultural exports	14,633 M$	2024	FAOSTAT (A4)
Agricultural imports	9,802 M$	2024	FAOSTAT (A4)
Mineral nitrogen, agricultural use	240,960 t	2024	FAOSTAT (A5)

Source: Table based on the sources indicated.

1. Green Solutions and our products

Green Solutions develops products for water, fertilisation and crop protection. Four families are of interest to this dossier. The yields cited are those published by the manufacturer or reported in the trials, with their confidence level.

Products covered by this dossier

Product	Claimed use	Published evidence (level)
EVERGREEN® (water-retention polymer)	Holds rain or irrigation water as a gel, near the roots.	Trials on maize, potato, watermelon, date palm and soybean. Level B to C.
ECOSORB® (water-retention polymer based on corn starch)	Same use; action lasting 2 to 3 years according to the website.	Soybean trial (China); laboratory acrylamide analysis. Level B to C.
ECOFERT® (fertiliser)	Fertiliser certified by SOHISCERT and EU Bio, usable in organic farming.	Published certificate; potato trial combined with EVERGREEN®. Level A (certificate), C (results).
Paulownia ALTIFOLIA®	Fast-growing tree for agroforestry.	Website figures; no trial in Chile. Level C.
Water Vital®, NAPEMA®	Outside the scope of this dossier.	No independent source in the documents consulted.

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

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



Wheat harvest in Fresia (Los Lagos).

2. Chile in figures

Chile had 19.86 million inhabitants in 2025, 11% of them in rural areas. Agriculture accounts for 3.5% of gross domestic product and employs 6% of the labour force. The country covers 742.0 thousand km², of which 14% is agricultural land. Undernourishment affects 2.5% of the population.

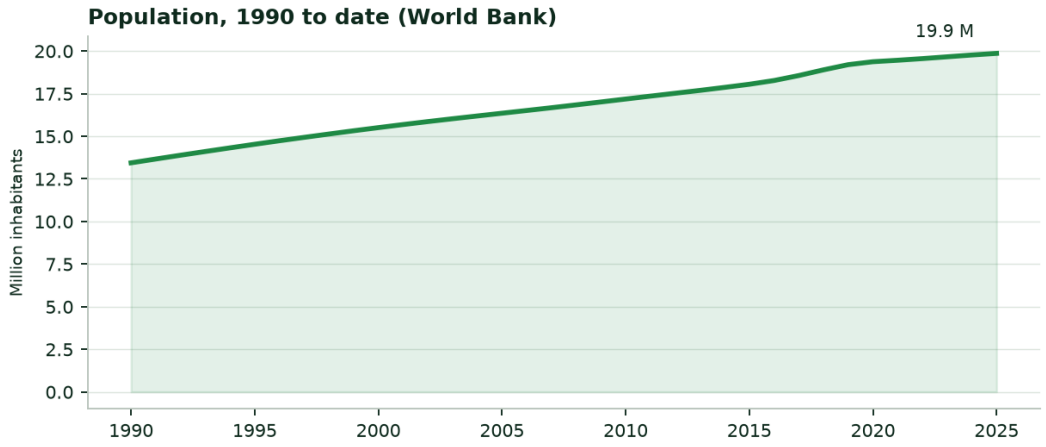


Figure 1. Population of Chile, 1990 to date. Source: World Bank (A1)

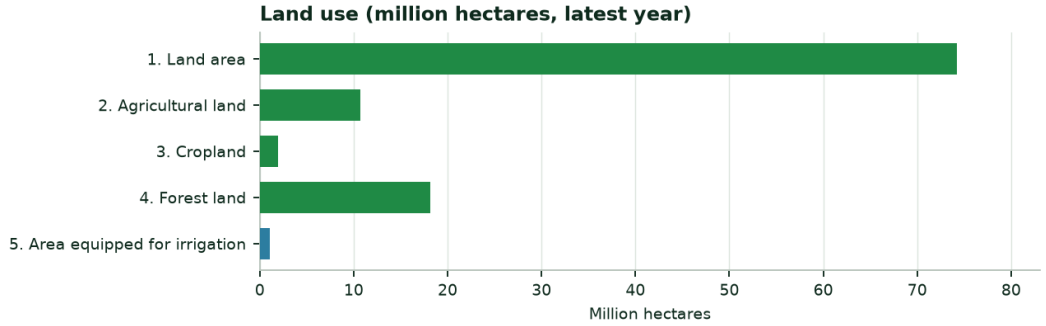


Figure 2. Land use, latest year published. Source: FAOSTAT (A6)

Agricultural and water indicators, latest year published

Indicator	Value	Year	Source
Cropland certified organic	19,380 ha	2024	FAOSTAT (A6)
Average cereal yield	6,606 kg/ha	2024	World Bank (A1)
Fertiliser use per hectare of arable land	263.8 kg/ha	2024	World Bank (A1)
Water withdrawals, agricultural share	90.9%	2022	World Bank (A1)
Internal freshwater resources	885.0 km³	2022	World Bank (A1)
Internal resources per inhabitant	45,262 m³	2022	World Bank (A1)



Carmenere vines in autumn, at Viña Tipaume.

3. Sunshine, rainfall and climate change

3.1 Sunshine

Global solar radiation reaches 1,096 to 2,445 kWh/m² a year depending on the region. Energy is not the limiting factor: Water available at the right time determines the harvest.

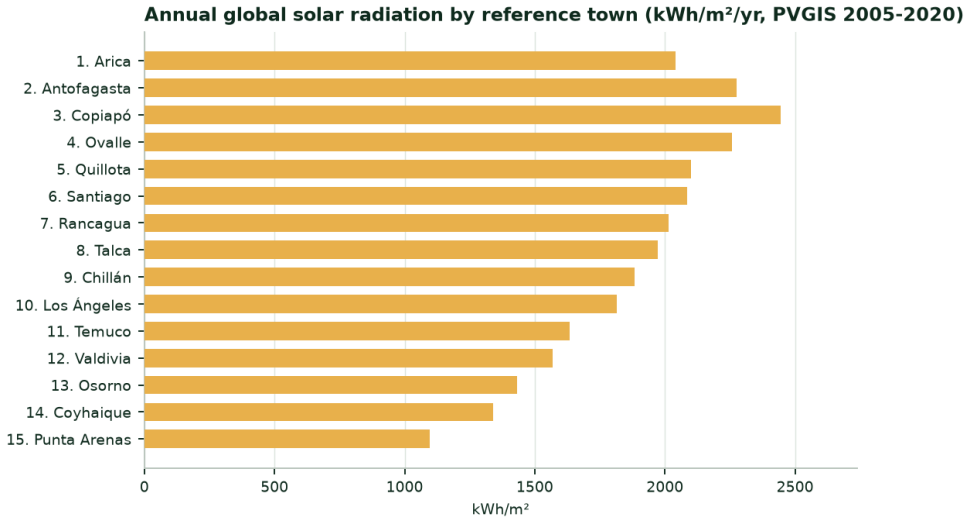


Figure 3. Annual global solar radiation in each reference town. Source: PVGIS (A8)

3.2 Rainfall and evapotranspiration

Annual rainfall is 1,240 mm at Osorno, but only 7 mm at Antofagasta, where reference evapotranspiration reaches 1,280 mm. Rain falls in winter, from May to August, and increases from north to south: Almost none in the Atacama Desert, moderate in the Central Valley, abundant in the south. Summer is dry across the centre: Fruit and vines there live on irrigation, fed by Andean snow.

Mean monthly rainfall, 1991-2020 (mm per month)

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Arica	5	3	2	0	0	1	4	2	2	1	1	2
Iquique	1	1	0	0	1	1	2	2	1	0	1	0
Antofagasta	0	1	1	0	0	2	0	1	0	0	0	0
Copiapó	2	2	2	1	5	11	5	5	1	1	1	1
Ovalle	1	1	2	4	18	34	20	16	6	4	2	1
Quillota	1	2	5	16	57	86	54	48	24	12	5	3
Santiago	8	8	9	17	48	77	47	40	25	14	8	7
Rancagua	10	10	12	20	54	84	50	45	29	18	10	10
Talca	6	14	14	42	100	146	98	85	52	36	19	12
Chillán	11	22	19	57	112	163	116	99	62	50	28	19
Los Ángeles	18	26	29	67	121	174	130	110	74	63	40	30
Temuco	25	32	41	84	140	199	152	129	86	78	54	44
Valdivia	39	39	62	98	152	213	172	152	93	88	70	58
Osorno	48	44	69	104	151	200	164	148	91	90	71	62
Coyhaique	52	45	65	78	99	109	90	89	56	65	62	57
Punta Arenas	57	47	62	60	54	44	45	44	37	37	43	52

Source: NASA POWER (A9); author's calculation.

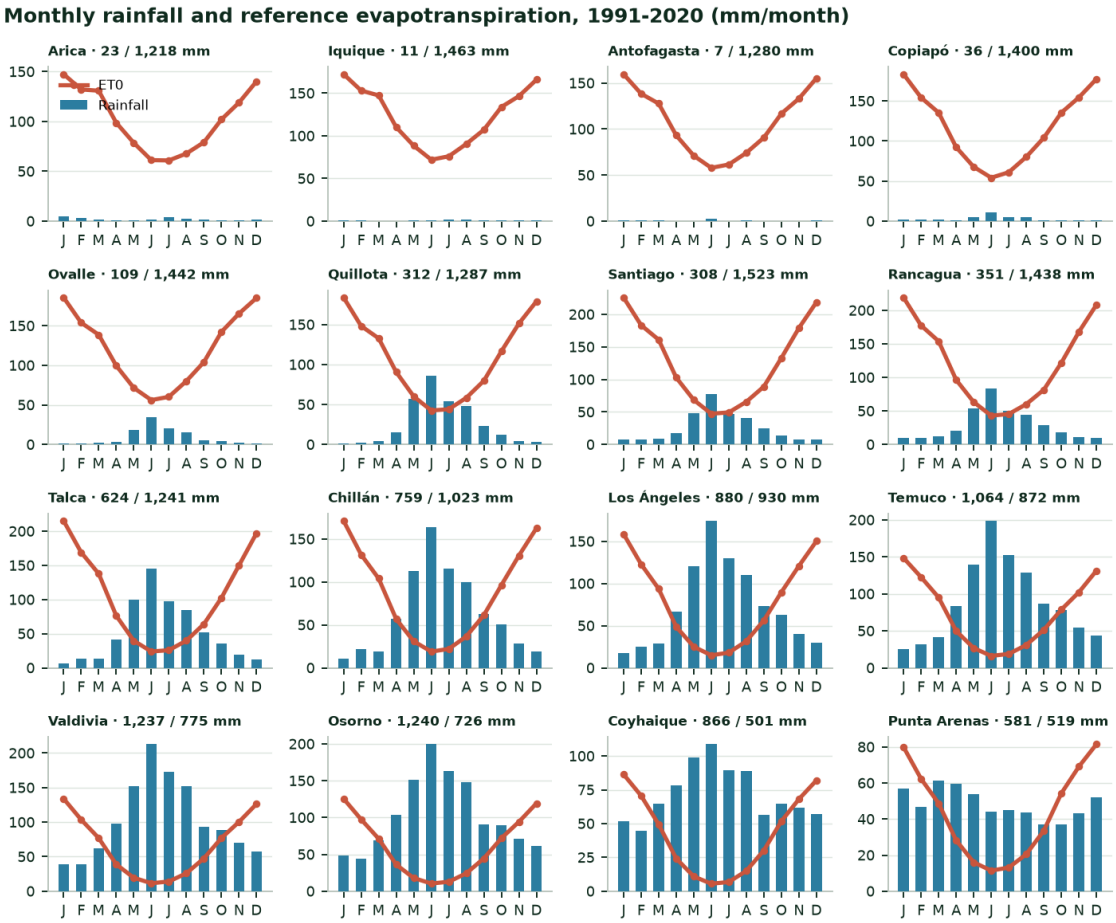
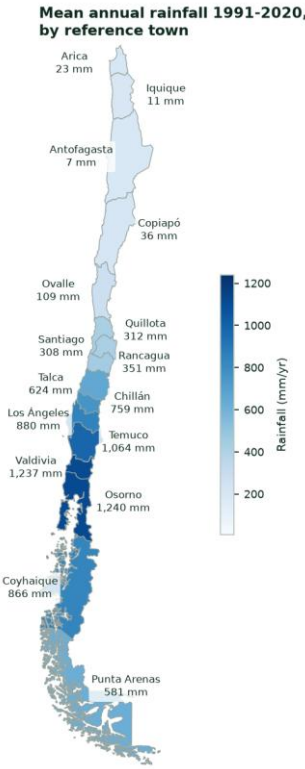
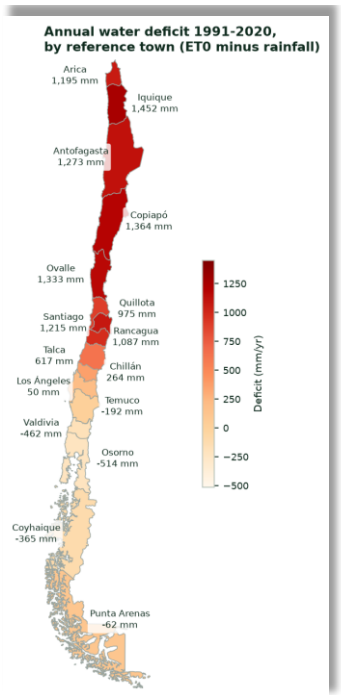


Figure 4. Monthly rainfall and reference evapotranspiration by city, 1991-2020. Source: NASA POWER (A9)





Annual water deficit, by region. Source: NASA POWER (A9), Natural Earth (A10).

Figure 5. Mean annual rainfall 1991-2020, by region. Source: NASA POWER (A9), Natural Earth (A10).

3.3 Climate change

Mean annual temperature is rising. At Santiago it went from 15.5 °C in 1981 to 16.0 °C in 2024, a trend of 0.15 °C per decade. At Talca the trend is 0.05 °C per decade, from 14.6 °C to 14.6 °C. Warmer air dries the soil faster between rainfall events.

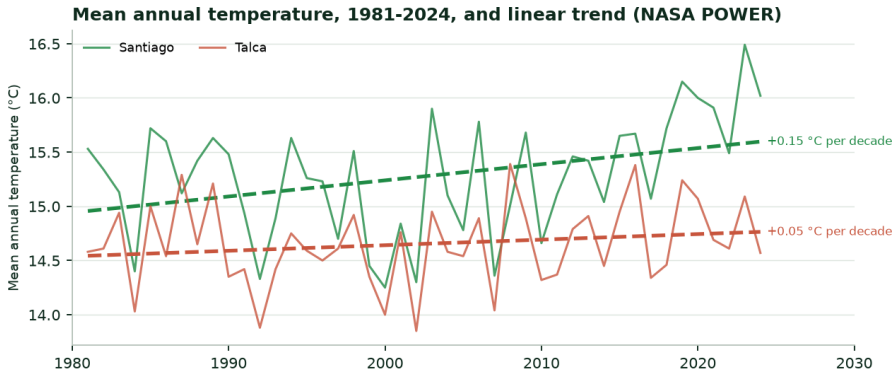


Figure 6. Mean annual temperature, 1981-2024, and linear trend. Source: NASA POWER (A9)



Irrigated crops of the Elqui valley, between dry mountains.

4. Water: Resources, irrigated areas, withdrawals

4.1 Resources and withdrawals

Total freshwater withdrawals are 35,368 million m³ a year (2022). Agriculture accounts for 90.9% of these withdrawals, that is 32,145 Mm³. Internal resources are 885.0 km³ a year and water stress is 9.0%: The country has water, but little of it is mobilised for crops.

Freshwater: Withdrawals and resources

Indicator	Value	Year	Source
Total withdrawals	35,368 Mm³	2022	World Bank (A1)
Agricultural share	90.9%	2022	World Bank (A1)
Agricultural withdrawals	32,144.8 Mm³	2022	Calculated from A1
Area equipped for irrigation	1,108,560 ha	2024	FAOSTAT (A6)
Agricultural withdrawals per equipped hectare	28,997 m³/ha	—	Calculation (Annex B)
Water stress	9.0%	2022	World Bank (A1)

4.2 Irrigated areas

FAOSTAT gives 1,108,560 ha equipped for irrigation in 2024, 58% of the cropland, and 909,400 ha actually irrigated (A6). Irrigation dominates from the northern desert down to Biobío: Fruit, vines, vegetables, maize and pastures of the centre depend on it; in the south, crops are mostly rainfed.



An irrigation canal in Hijuelas (Valparaíso).

4.3 What the water saving represents

In the central scenario, the saving is 3,989.1 million m³ a year, or 12.4% of agricultural withdrawals. At 28,997 m³ per equipped hectare, this water would irrigate about 137,571 more hectares, or 12.4% of today's equipped area.

5. Fertilisers: Quantities, purchases, spending

5.1 Quantities used

In 2024, agricultural use reaches 240,960 tonnes of nitrogen, 125,453 tonnes of phosphate (P2O5) and 5,510 tonnes of potash (K2O). The country produces 46,722 tonnes of nitrogen and 0 tonnes of phosphate (P2O5); it imported 329,761 tonnes of nitrogen in the same year. Per hectare of arable land, use is 263.8 kg per hectare.

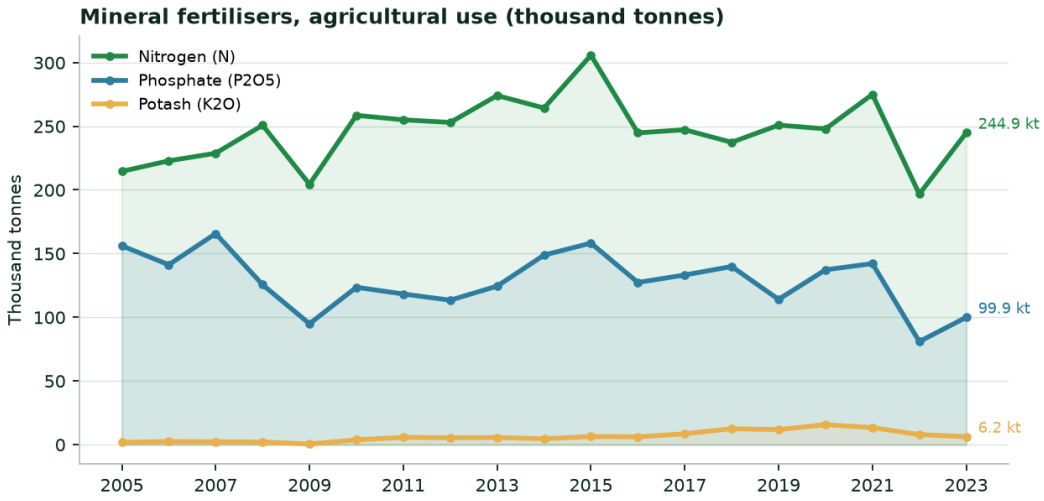


Figure 7. Mineral fertilisers, agricultural use, 2005-2023. Source: FAOSTAT (A5)

5.2 Regulatory framework

Law No. 21,349 of 2021 sets rules for the composition, labelling and marketing of fertilisers and biostimulants; its regulation creates a national register of manufacturers and importers, and the SAG checks labelling (A13).



Wheat fields in Traiguén (Araucanía).

5.3 Indicative spending

In 2024, the indicative minimum spending on mineral fertilisers reaches $309 million, at international fertiliser prices (calculation in Annex B, lower bound).

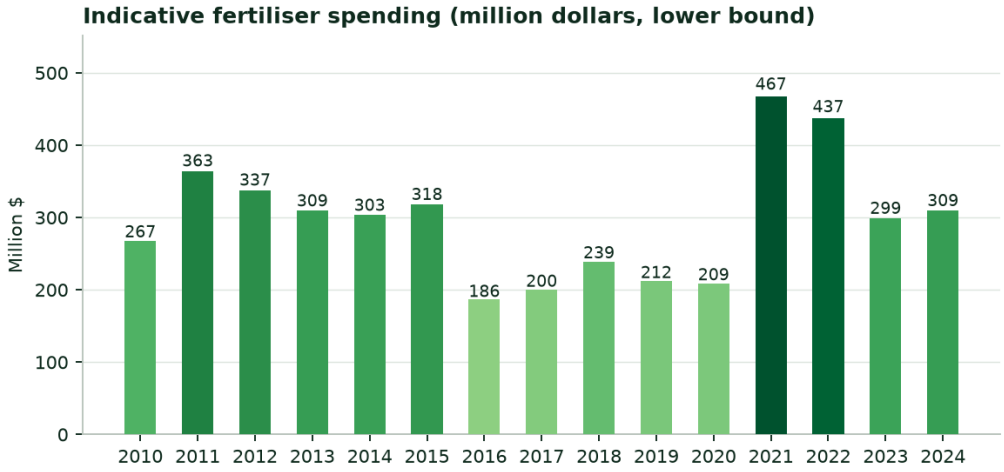


Figure 8. Indicative fertiliser spending, lower bound. Source: Author's calculation from A5 and A7

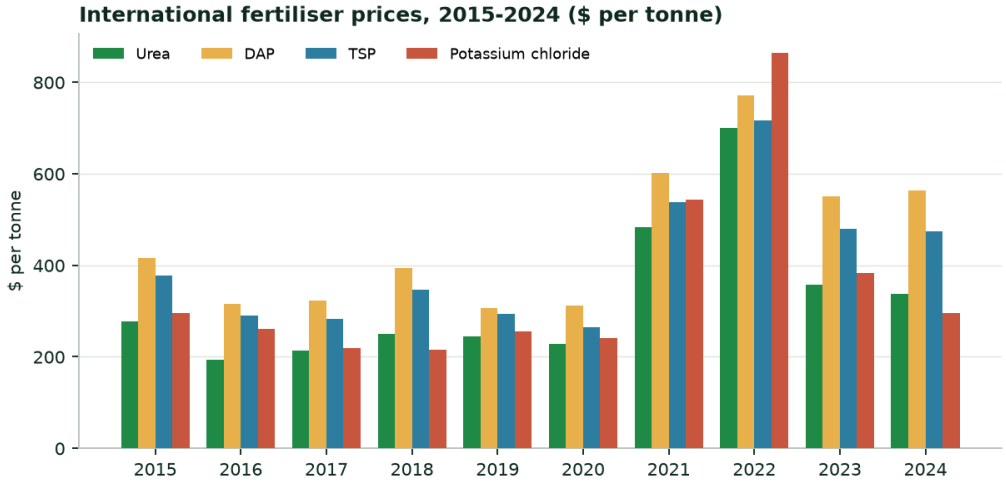


Figure 9. International prices of urea, DAP, TSP and potassium chloride. Source: World Bank, Pink Sheet (A7)

6. The regions at a glance

The table compares the sixteen regions, each represented by a reference town. Climate figures are 1991-2020 averages, except radiation (2005-2020).

Climate of the capitals, 1991-2020 means

Region (city)	Rainfall (mm/yr)	ET0 (mm/yr)	Deficit (mm/yr)	Radiation (kWh/m²/yr)	Temperature (°C)
Arica y Parinacota (Arica)	23	1,218	1,195	2,040	19.6
Tarapacá (Iquique)	11	1,463	1,452	0	17.9
Antofagasta (Antofagasta)	7	1,280	1,273	2,275	17.8
Atacama (Copiapó)	36	1,400	1,364	2,445	16.4
Coquimbo (Ovalle)	109	1,442	1,333	2,257	16.8
Valparaíso (Quillota)	312	1,287	975	2,100	15.2
Santiago Metropolitan (Santiago)	308	1,523	1,215	2,087	15.2
O'Higgins (Rancagua)	351	1,438	1,087	2,014	14.5
Maule (Talca)	624	1,241	617	1,973	14.7
Ñuble (Chillán)	759	1,023	264	1,882	14.3
Biobío (Los Ángeles)	880	930	50	1,816	13.1

Region (city)	Rainfall (mm/yr)	ET0 (mm/yr)	Deficit (mm/yr)	Radiation (kWh/m²/yr)	Temperature (°C)
Araucanía (Temuco)	1,064	872	-192	1,635	11.3
Los Ríos (Valdivia)	1,237	775	-462	1,568	10.8
Los Lagos (Osorno)	1,240	726	-514	1,433	10.5
Aysén (Coyhaique)	866	501	-365	1,340	4.7
Magallanes (Punta Arenas)	581	519	-62	1,096	6.3

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

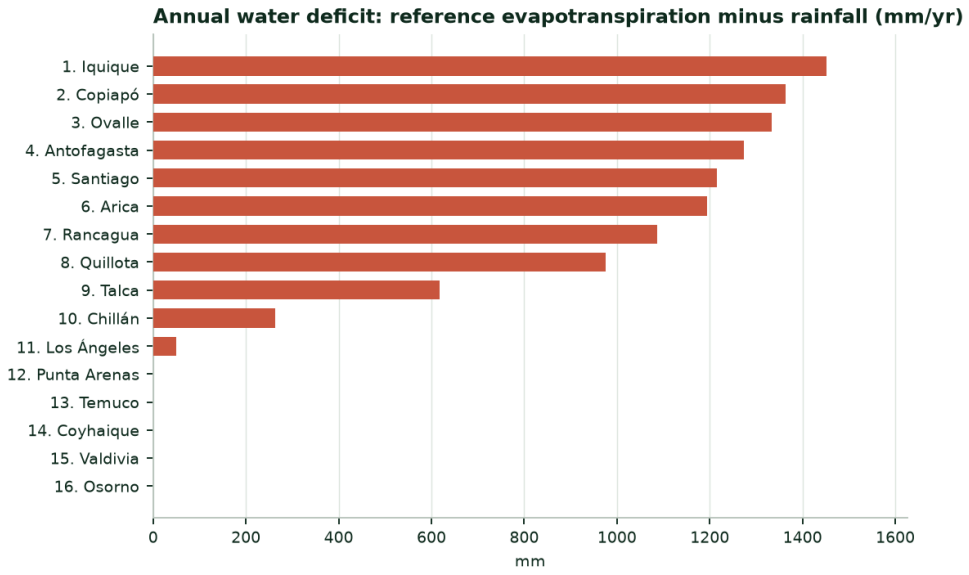


Figure 10. Annual water deficit: Reference evapotranspiration minus rainfall. Source: NASA POWER (A9)



Vines and orchards of the Elqui valley.

7. The twenty main crops: Three rankings

7.1 By harvested area

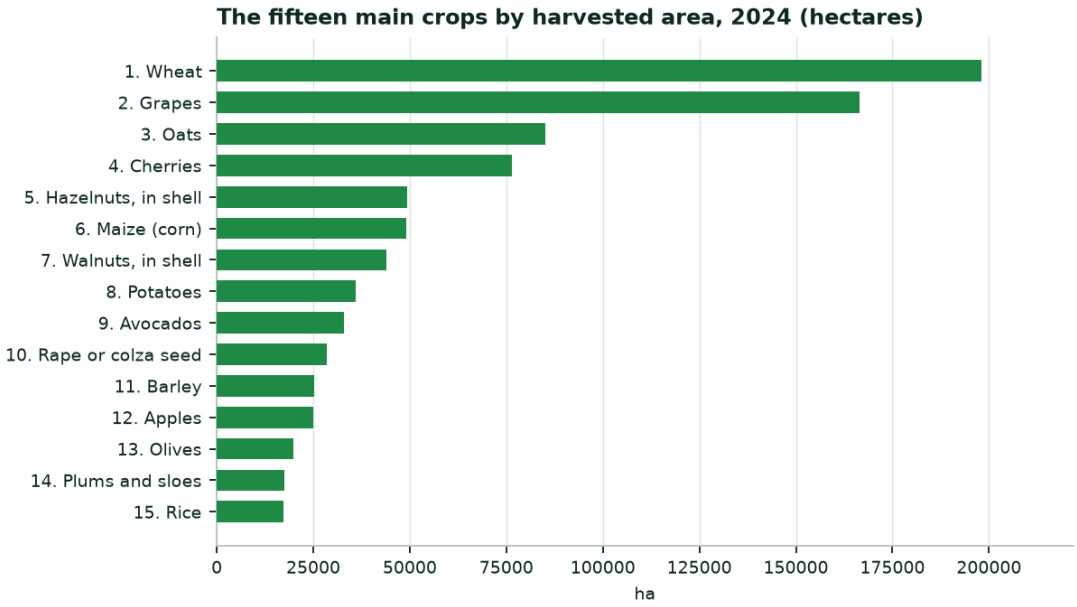


Figure 11. The fifteen main crops by harvested area, 2024 (hectares). Source: FAOSTAT (A2)

The ten main crops by area, 2024

Crop	Harvested area (ha)	Production (t)	Yield (t/ha)
Wheat	198,067	1,188,785	6.00
Grapes	166,457	2,453,897	14.74
Oats	85,215	457,567	5.37
Cherries	76,447	596,968	7.81
Hazelnuts, in shell	49,264	73,274	1.49
Maize (corn)	49,132	530,937	10.81
Walnuts, in shell	43,990	175,000	3.98
Potatoes	36,074	1,246,278	34.55
Avocados	33,025	181,307	5.49
Rape or colza seed	28,440	123,068	4.33

Source: FAOSTAT (A2).

7.2 By production

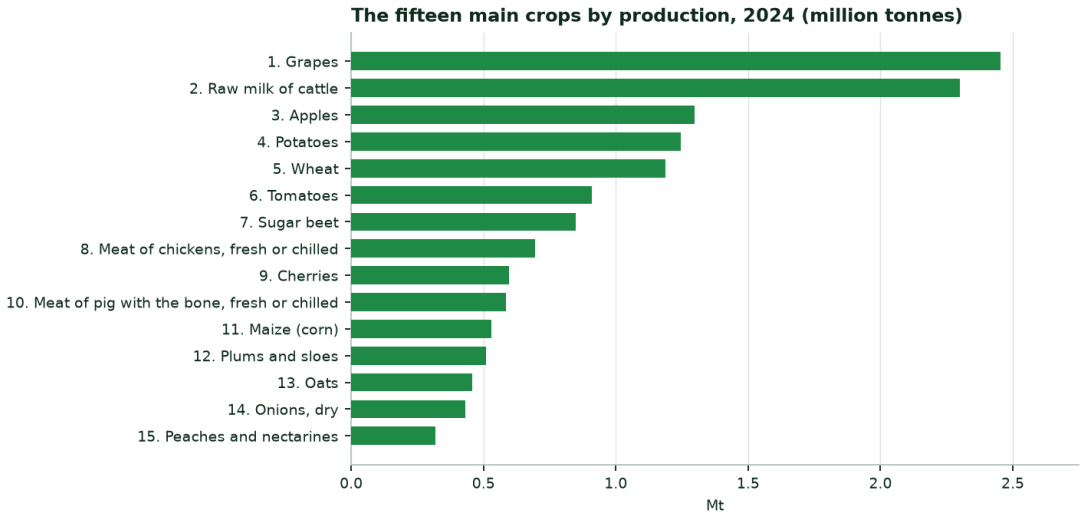


Figure 12. The fifteen main crops by production, 2024 (million tonnes). Source: FAOSTAT (A2)

7.3 By production value

By production value, the three main crops are: Grapes, cherries and apples (FAOSTAT, 2023, constant international dollars).

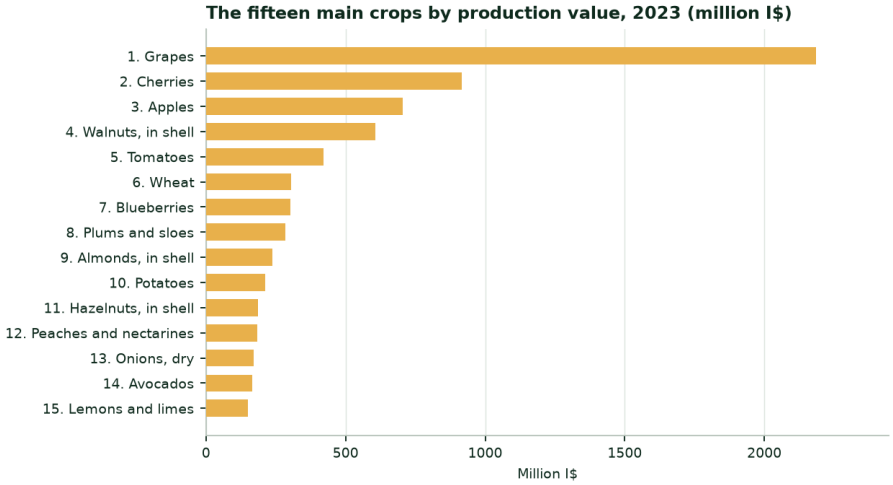


Figure 13. The fifteen main crops by production value, 2023 (million I$). Source: FAOSTAT (A3)



Grapes ready for harvest at Viña Undurraga.

8. Extrapolation by crop: Irrigation and rainfed crops

8.1 Method

Method in brief

• **Irrigation.** National agricultural water is shared between irrigated crops (vegetables and melons, potato, maize, vines, fruit and nuts, irrigated rice and other irrigated land), in proportion to their harvested areas; the equipped area is shared the same way.

• Each calculation applies the effect of the trial cited: A quarter (cautious), half (central) or the full effect (high). Without a trial: 5, 10 and 20% of water, with no yield gain.

8.2 Trials used as analogues

Trials cited and their use in the calculation

Trial	Crop	Water	Yield	Use in the calculation
Maize, Türkiye (TIGEM, Konya, 2025)	Maize	-38.9%	+17.1%	Maize: Water and yield
Soybean, China	Soybean	Assumption	+11.3%	Not used; cited for reference
Watermelon, Mexico (2023)	Watermelon	-60.5%	+30.0%	Vegetables and melons: Water and yield
Potato, South Africa (2025)	Potato	-52.0%	+31.4%	Potato: Water and yield
Date palm, UAE (ICBA, 2021)	Palm	-82.0%	+20.0%	Not used; cited for reference

Source: A14 to A18 (published trials and manufacturer's website, levels B and C).

No trial has yet been conducted in Chile: The figures below apply the results of the cited trials to the country's average yields.

8.3 Irrigation: Vegetables and melons, Potato, Maize and Vines

Equipped area assigned, trial used and water saved (central scenario)

Crop group	Equipped area (ha)	Share	Trial or assumption	Water saved (Mm³/yr)
Vegetables and melons (tomato, onion, sweet corn, others)	80,375	7.3%	Watermelon, Mexico (2023)	705.0
Potato	36,074	3.3%	Potato, South Africa (2025)	272.0
Maize (irrigated)	49,132	4.4%	Maize, Türkiye (TIGEM, 2025)	277.8
Vines (wine, table and pisco grapes)	166,457	15.0%	Generic assumption, no trial	482.7
Fruit and nuts (cherry, apple, avocado, walnut, hazelnut, others)	351,090	31.7%	Generic assumption, no trial	1,018.1
Irrigated rice	17,370	1.6%	Generic assumption, no trial	50.4
Other irrigated land (pastures, lucerne, sugar beet, irrigated wheat)	408,062	36.8%	Generic assumption, no trial	1,183.3

Source: Author's calculation (Annex B).

Water saved, extra irrigable hectares and production gain, by scenario

Scenario	Water (Mm³/yr)	Extra hectares	Production (t/yr)
Cautious	1,994.6	68,786	306,687
Central	3,989.1	137,571	613,373

Scenario	Water (Mm³/yr)	Extra hectares	Production (t/yr)
High	7,978.3	275,143	1,226,746

Source: Author's calculation (Annex B).

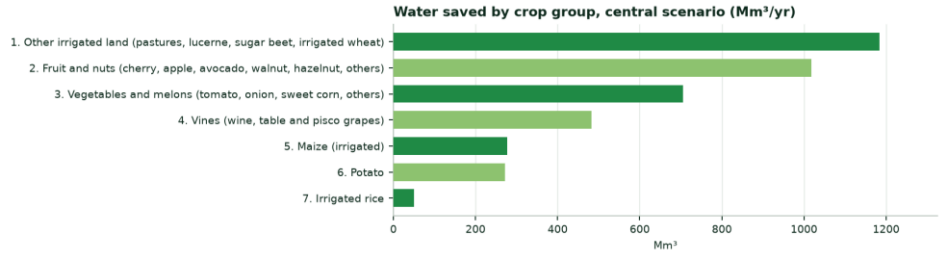


Figure 14. Water saved by crop group, central scenario. Source: Author's calculation

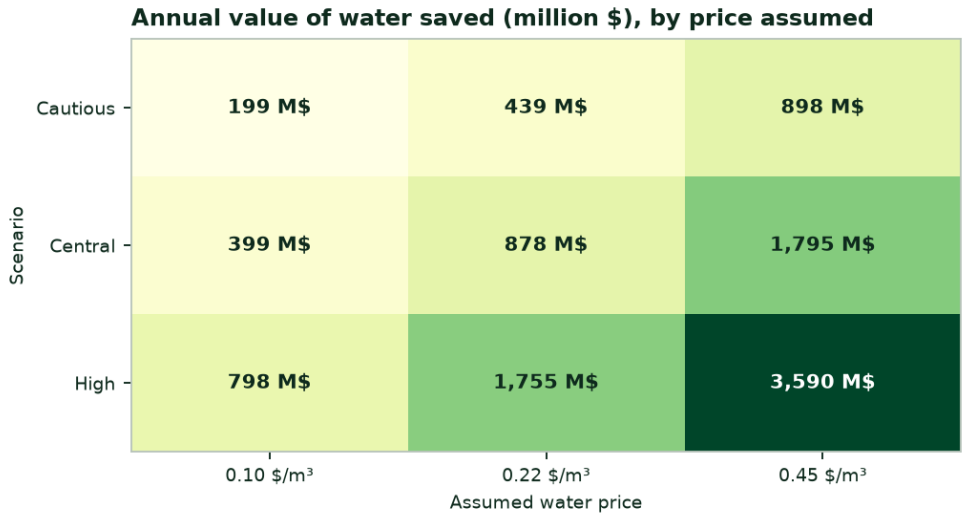


Figure 15. Annual value of the water saved, by price assumed per cubic metre. Source: Author's calculation; prices assumed, no national tariff

8.4 Reading the results

Key points

• The "other irrigated land" group gives 30% of the irrigation water saving (generic assumption, no trial).

• The gains are counted by scenario and, in rainfed farming, per 10,000 ha treated: A cooperative or a public programme can scale them to its own area.

9. Potential benefits of our products

The table lists what the products may bring according to the documents available, with the confidence level and limitations of each.

Potential benefits, by situation

Benefit	Published figures	Source (level)	Limit
Irrigation water saving	Date palm −82%; watermelon −60.5%; potato −52%; maize −38.9%	A14 to A18 (B, C)	One trial per crop; none in Chile
Yield	Maize +17.1%; potato +31.4%; watermelon +30%; date palm +20%; soybean +11.2 to +11.4%	A14 to A18 (B, C)	Trials conducted under irrigation or in other climates

Benefit	Published figures	Source (level)	Limit
Organic farming (ECOFERT®)	Certified by SOHISCERT and EU Bio	A21 (A)	Valid for the certified product
Safety: Acrylamide (ECOSORB®)	Below 3.0 µg/g	A19 (B)	One laboratory, one date
REACH compliance (EVERGREEN®)	≤ 0.1% of substances of very high concern in 233 substances tested	A20 (B)	Screening, not an approval
Agroforestry (Paulownia ALTIFOLIA®)	13 to 15 m in 6 to 8 years (website)	A22 (C)	No trial in Chile

Source: Annex A.



Cherries in La Candelaria, Chépica (O'Higgins).

10. External trade: Exports, imports, importing

10.1 Overview, 2023 and 2024

Agricultural products and total merchandise trade (million $)

Indicator	2023	2024
Agricultural exports (crops and livestock)	13,717	14,633
Agricultural imports (crops and livestock)	9,830	9,802
Exports, all merchandise	94,937	100,162
Imports, all merchandise	85,506	84,154

Source: FAOSTAT (A4).

10.2 Exports

The three main farm products exported in 2024 are: Cherries ($3,264 million), wine ($1,619 million) and grapes ($1,104 million).

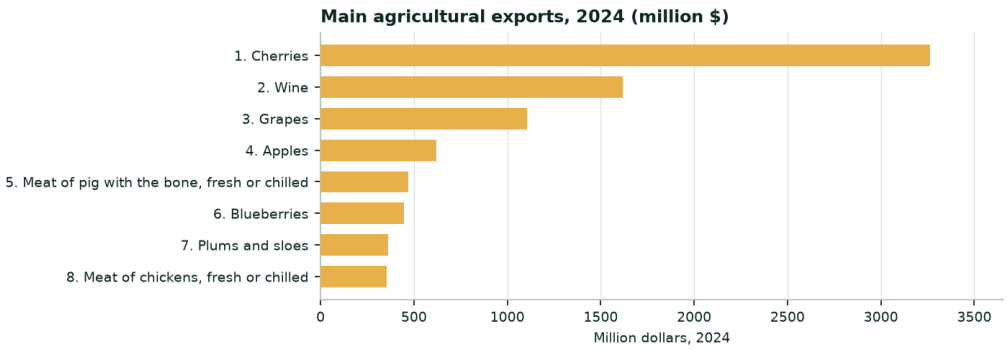


Figure 16. Main agricultural exports, 2024. Source: FAOSTAT (A4)

10.3 Imports

The main farm purchases are: Boneless beef, fresh or chilled ($1,471 million), maize (corn) ($626 million) and soya bean cake ($496 million).

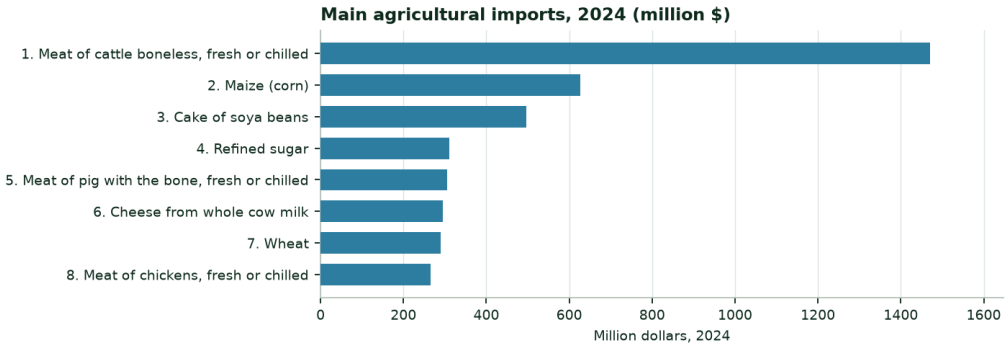


Figure 17. Main agricultural imports, 2024. Source: FAOSTAT (A4)



Figure 18. Old vines on granitic soil in Sauzal (Maule).



La Vega Central market, in Santiago.

10.4 Importing water-retention polymers into Chile

What to know

• **Customs duty (subheading 3906.90):** Uniform rate of 6%, as for most goods (A11). Chile's many trade agreements can bring this duty down to zero depending on the product's origin.

• **VAT (IVA):** Rate of 19% (A12).

• **Placing on the market:** Law No. 21,349 governs the composition, labelling and sale of fertilisers and biostimulants; manufacturers and importers enter a national register kept by the SAG, which checks labelling (A13). The classification of a water-retaining agent is to be confirmed with the SAG.

• **Classification:** Code 3906.90 is an inference for our products; the National Customs Service settles it.

11. A study of each region

Each region is described through the city that represents it. The figures describe the climate; the water deficit (evapotranspiration minus rainfall) shows where water is scarcest. The description of crops is qualitative.



The Elqui valley (Coquimbo).

Arica y Parinacota (Arica)

Arica y Parinacota: Tomatoes, olives and sweet corn of the Azapa valley, irrigated in the desert.

Indicator	Value
Annual rainfall, 1991-2020	23 mm
Reference evapotranspiration	1,218 mm
Annual water deficit	1,195 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,040 kWh/m²
Mean temperature	19.6 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Tarapacá (Iquique)

Tarapacá: An almost rainless desert; small oases of vegetables and lucerne at Pica and Matilla.

Indicator	Value
Annual rainfall, 1991-2020	11 mm
Reference evapotranspiration	1,463 mm
Annual water deficit	1,452 mm
Months with less than 50 mm of rain	12
Global solar radiation	0 kWh/m²
Mean temperature	17.9 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Antofagasta (Antofagasta)

Antofagasta: The Atacama Desert; some vegetables and livestock in the oases of Calama and San Pedro.

Indicator	Value
Annual rainfall, 1991-2020	7 mm
Reference evapotranspiration	1,280 mm
Annual water deficit	1,273 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,275 kWh/m²
Mean temperature	17.8 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Atacama (Copiapó)

Atacama: Early table grapes and olives of the Copiapó valley, on a heavily used aquifer.

Indicator	Value
Annual rainfall, 1991-2020	36 mm
Reference evapotranspiration	1,400 mm
Annual water deficit	1,364 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,445 kWh/m²
Mean temperature	16.4 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Coquimbo (Ovalle)

Coquimbo: Pisco and table grapes, avocados and citrus of the Limarí and Elqui valleys, hit by long droughts.

Indicator	Value
Annual rainfall, 1991-2020	109 mm
Reference evapotranspiration	1,442 mm
Annual water deficit	1,333 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,257 kWh/m²
Mean temperature	16.8 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Valparaíso (Quillota)

Valparaíso: Avocados, citrus and vines of Aconcagua and Casablanca; Petorca province is short of water.

Indicator	Value
Annual rainfall, 1991-2020	312 mm
Reference evapotranspiration	1,287 mm
Annual water deficit	975 mm
Months with less than 50 mm of rain	9
Global solar radiation	2,100 kWh/m²
Mean temperature	15.2 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Santiago Metropolitan (Santiago)

Santiago Metropolitan: Maipo vines, fruit, vegetables and maize around the capital.

Indicator	Value
Annual rainfall, 1991-2020	308 mm
Reference evapotranspiration	1,523 mm
Annual water deficit	1,215 mm
Months with less than 50 mm of rain	11
Global solar radiation	2,087 kWh/m²
Mean temperature	15.2 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

O'Higgins (Rancagua)

O'Higgins: Cherries, grapes, apples, walnuts and Colchagua vines; the leading fruit region.

Indicator	Value
Annual rainfall, 1991-2020	351 mm
Reference evapotranspiration	1,438 mm
Annual water deficit	1,087 mm
Months with less than 50 mm of rain	9
Global solar radiation	2,014 kWh/m²
Mean temperature	14.5 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Maule (Talca)

Maule: Vines, apples, cherries, blueberries and cereals; the country's largest vine area.

Indicator	Value
Annual rainfall, 1991-2020	624 mm
Reference evapotranspiration	1,241 mm
Annual water deficit	617 mm
Months with less than 50 mm of rain	7
Global solar radiation	1,973 kWh/m²
Mean temperature	14.7 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Ñuble (Chillán)

Ñuble: Cereals, sugar beet, blueberries and hazelnuts, between irrigated and rainfed farming.

Indicator	Value
Annual rainfall, 1991-2020	759 mm
Reference evapotranspiration	1,023 mm
Annual water deficit	264 mm
Months with less than 50 mm of rain	5
Global solar radiation	1,882 kWh/m²
Mean temperature	14.3 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Biobío (Los Ángeles)

Biobío: Wheat, maize, sugar beet, hazelnuts and planted forest.

Indicator	Value
Annual rainfall, 1991-2020	880 mm
Reference evapotranspiration	930 mm
Annual water deficit	50 mm
Months with less than 50 mm of rain	5
Global solar radiation	1,816 kWh/m²
Mean temperature	13.1 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Araucanía (Temuco)

Araucanía: Rainfed wheat, oats, rapeseed, lupin and potato; the country's cereal granary.

Indicator	Value
Annual rainfall, 1991-2020	1,064 mm
Reference evapotranspiration	872 mm
Annual water deficit	-192 mm
Months with less than 50 mm of rain	4
Global solar radiation	1,635 kWh/m²
Mean temperature	11.3 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Los Ríos (Valdivia)

Los Ríos: Dairy pastures and cereals, in a very rainy climate.

Indicator	Value
Annual rainfall, 1991-2020	1,237 mm
Reference evapotranspiration	775 mm
Annual water deficit	-462 mm
Months with less than 50 mm of rain	2
Global solar radiation	1,568 kWh/m²
Mean temperature	10.8 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Los Lagos (Osorno)

Los Lagos: Milk, beef, potato and cereals; the leading dairy region.

Indicator	Value
Annual rainfall, 1991-2020	1,240 mm
Reference evapotranspiration	726 mm
Annual water deficit	-514 mm
Months with less than 50 mm of rain	2
Global solar radiation	1,433 kWh/m²
Mean temperature	10.5 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Aysén (Coyhaique)

Aysén: Cattle and sheep; farming limited by the cold.

Indicator	Value
Annual rainfall, 1991-2020	866 mm
Reference evapotranspiration	501 mm
Annual water deficit	-365 mm
Months with less than 50 mm of rain	1
Global solar radiation	1,340 kWh/m²
Mean temperature	4.7 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Magallanes (Punta Arenas)

Magallanes: Extensive sheep farming on the windy steppe.

Indicator	Value
Annual rainfall, 1991-2020	581 mm
Reference evapotranspiration	519 mm
Annual water deficit	-62 mm
Months with less than 50 mm of rain	7
Global solar radiation	1,096 kWh/m²
Mean temperature	6.3 °C

Source: NASA POWER (A9); PVGIS (A8); author's calculation.

Annex A. Sources and confidence levels

Ref.	Source	Level
A1	World Bank, World Development Indicators (WDI), Chile	A
A2	FAOSTAT, crops and livestock (QCL), areas, production, 2014-2024	A
A3	FAOSTAT, value of production (QV), constant 2014-2016 I$, 2019-2024	A
A4	FAOSTAT, trade in crops and livestock products, 2018-2024	A
A5	FAOSTAT, mineral fertilisers, agricultural use, production and imports, 2005-2023	A
A6	FAOSTAT, land use, areas equipped for irrigation, organic farming	A
A7	World Bank, Pink Sheet (world prices of urea, DAP, TSP and potassium chloride)	A
A8	PVGIS (European Commission Joint Research Centre), radiation, 2005-2020	B
A9	NASA POWER (NASA Langley Research Center), daily data: Rainfall, temperature, humidity, wind and radiation, 1981-2024; reference evapotranspiration calculated by the author with FAO-56 (Penman-Monteith)	B
A10	Natural Earth, first-level administrative boundaries and country outline	B
A11	World Bank, WITS (UNCTAD TRAINS database), Chile, applied MFN duties, subheading 3906.90 (one national line), 2023	A
A12	PwC, Worldwide Tax Summaries, Chile, other taxes: Value-added tax (IVA)	C
A13	Law No. 21,349 of 2021 setting rules for the composition, labelling and marketing of fertilisers and biostimulants, its regulation, and SAG exempt resolutions No. 8651 and 8654 of 2024	A
A14	Soybean trial, China (yield), manufacturer's website	C
A15	Date palm trial, UAE (ICBA, 2021), manufacturer's website	B
A16	Watermelon trial, Mexico (2023), manufacturer's website	C
A17	Potato trial, South Africa (2025), manufacturer's website	C
A18	Maize trial, Türkiye (TIGEM, Konya, 2025), manufacturer's website	B

Ref.	Source	Level
A19	ECOSORB® acrylamide analysis (Polymex laboratory, 2024)	B
A20	EVERGREEN® REACH / SVHC screening (SGS, 2023)	B
A21	ECOFERT® certificate (SOHISCERT, EU Bio)	A
A22	Paulownia ALTIFOLIA® sheet figures (website)	C

Annex B. Calculation method

1. Agricultural water. Total withdrawals (35,368 Mm³, 2022) × agricultural share (90.89%) = 32,144.8 Mm³.

2. Irrigation. The equipped area (1,108,560 ha) and agricultural water are shared between irrigated groups (vegetables and melons, potato, maize, vines, fruit and nuts, irrigated rice and other irrigated land) in proportion to their harvested areas (1,108,560 ha), without exceeding each group's harvested area. Our sources provide no irrigation statistics by crop. Other crops are treated as rainfed and receive no irrigation water in the calculation. The equipped area exceeds the harvested area of the selected irrigable crops: The difference forms an "other irrigated land" group (pastures and fodder, lucerne, sugar beet, irrigated wheat), with the generic assumption. Maize is treated as irrigated, as in the Central Valley; wheat, oats, barley, rapeseed and lupin are treated as rainfed.

3. Scenarios. Water saved = group water × trial effect: A quarter (cautious), half (central) or the full effect (high). Without a trial: 5, 10 and 20%.

4. Extra hectares. Water saved ÷ water per equipped hectare (28,997 m³/ha).

6. Value of water. Three assumed prices (0.10; 0.22 and 0.45 $/m³); no national tariff was adopted.

7. Fertilisers. Minimum spending = nitrogen ÷ 0.46 × urea price + phosphate ÷ 0.46 × TSP price + potash ÷ 0.60 × potassium chloride price (A7).

8. Climate. Rainfall, reference evapotranspiration (FAO-56) and temperature: 1991-2020 means of the NASA POWER grid cell containing each city; radiation: PVGIS, 2005-2020. Temperature trends are linear regressions over 1981-2024. NASA POWER combines reanalyses and satellite data on a grid of about 50 km: Two nearby cities can share the same cell, and its rainfall can differ from local station records. On the maps, each region is coloured according to the value of its reference town.

9. Trade. Totals are those of the FAOSTAT crops and livestock line; products are listed one by one, without aggregates. Rice amounts add husked rice, broken rice and milled rice.

Annex C. Photo credits

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Vineyards in Alto del Carmen (Atacama).

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