

COUNTRY DOSSIER

South Africa

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

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Vineyards of Stellenbosch, at the foot of the mountains.

Foreword

This dossier describes South Africa 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 short, for which crops, and in which regions? It then examines what our products can change, 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, South African public bodies (Stats SA, Department of Agriculture, revenue service SARS)).
- **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 South Africa.

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Summary

The points below summarise the dossier. The figures come from public sources: The World Bank, FAO (FAOSTAT, AQUASTAT), South African public bodies (Stats SA, Department of Agriculture, revenue service SARS), PVGIS and ERA5. The production gains and water savings are scenarios, described in Annex B.

64.75 M
Inhabitants in 2025 (World Bank)

2.64 M ha
Of maize (corn) harvested in 2024, the main crop

2.24 M ha
Equipped for irrigation (2024)

+4,168 t
Of maize per 10,000 ha treated, central scenario

1,519 Mm³
Of irrigation water saved a year, central scenario

13,192 M$
Of agricultural exports in 2024 (FAOSTAT)

Key points

- **Irrigation, a pillar of production.** 2.24 million hectares equipped for irrigation in 2024, or 18% of the 12.41 million hectares of cropland.
- **Maize (corn): The main crop.** 2,636,250 ha harvested in 2024, for 12.85 million tonnes, or 4.87 t/ha.
- **Water is scarce.** National water stress reaches 67.6%; at Upington, the air demands 2,021 mm more than it rains.
- **In rainfed farming, the gain is counted in tonnes.** In the central scenario, 4,168 t of maize and 908 t of soybean more per 10,000 ha treated.
- **In irrigation, the water saved enlarges the schemes.** 1,519.4 Mm³ a year in the central scenario, enough to irrigate about 271,400 more ha, or 12.1% of the equipped area.
- **An organic chain.** 15,310 ha of certified organic cropland in 2024: ECOFERT® is EU Bio certified.
- **Fertilisers made locally.** 640,129 t of nitrogen used in 2024; the country produces 172,469 t and imports 640,129 t.
- **Farm trade.** $13,192 million of exports and $7,141 million of imports in 2024. First sale: Maize (corn) ($863 million). Rice weighs $641 million of purchases.

Key figures

Key indicators for South Africa

Indicator	Value	Year	Source (level)
Population	64.75 M	2025	World Bank (A1)
GDP per capita	6,598 $	2025	World Bank (A1)
Agriculture share of GDP	2.8%	2025	World Bank (A1)
Agricultural employment	5.4%	2025	World Bank (A1)
Cropland	12,413,000 ha	2024	FAOSTAT (A6)
Area equipped for irrigation	2,239,760 ha	2024	FAOSTAT (A6)
Harvested area: Maize (corn)	2,636,250 ha	2024	FAOSTAT (A2)
Certified organic cropland	15,310 ha	2024	FAOSTAT (A6)
Agricultural exports	13,192 M$	2024	FAOSTAT (A4)

Indicator	Value	Year	Source (level)
Agricultural imports	7,141 M$	2024	FAOSTAT (A4)
Mineral nitrogen, agricultural use	640,129 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 by 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 South Africa. 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 fields near Bredasdorp, in the Overberg.

2. South Africa in figures

South Africa had 64.75 million inhabitants in 2025, 36% of them in rural areas. Agriculture accounts for 2.8% of gross domestic product and employs 5% of the labour force. The country covers 1,213.1 thousand km², of which 79% is agricultural land. Undernourishment affects 11.2% of the population.

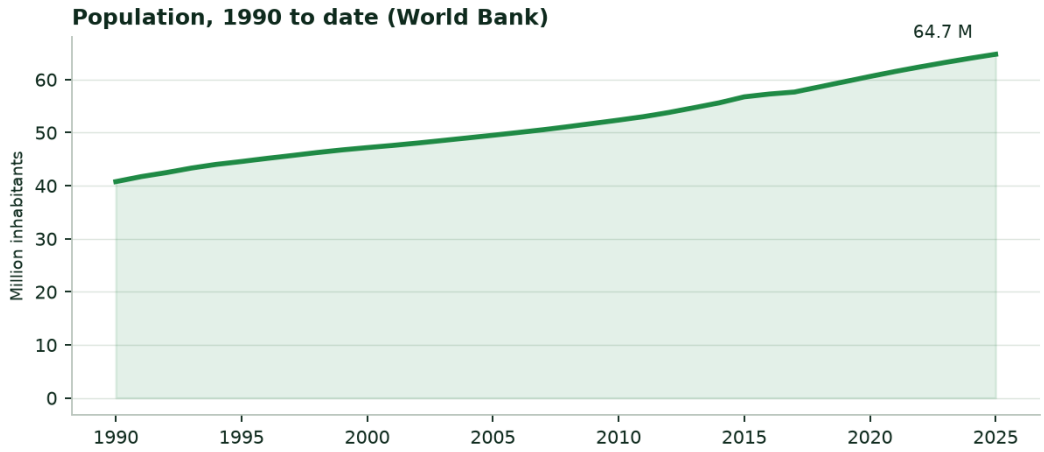


Figure 1. Population of South Africa, 1990 to date. Source: World Bank (A1)

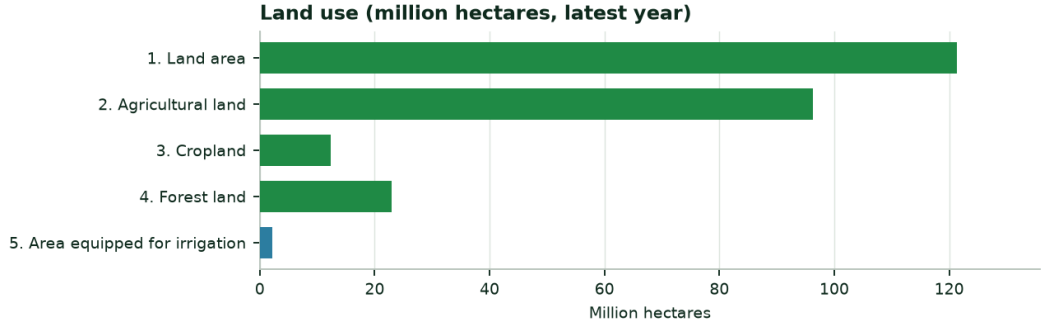


Figure 2. Land use, latest year published. Source: FAOSTAT (A6)

Agricultural and water indicators, latest year published

Indicator	Value	Year	Source
Cropland certified organic	15,310 ha	2024	FAOSTAT (A6)
Average cereal yield	4,562 kg/ha	2024	World Bank (A1)
Fertiliser use per hectare of arable land	120.3 kg/ha	2024	World Bank (A1)
Water withdrawals, agricultural share	59.4%	2022	World Bank (A1)
Internal freshwater resources	44.8 km³	2022	World Bank (A1)
Internal resources per inhabitant	718 m³	2022	World Bank (A1)



A worker in a vineyard on the wine route, near Upington.

3. Sunshine, rainfall and climate change

3.1 Sunshine

Global solar radiation reaches 1,644 to 2,235 kWh/m² a year depending on the region. Energy is not the limit: Water available at the right time makes the harvest.

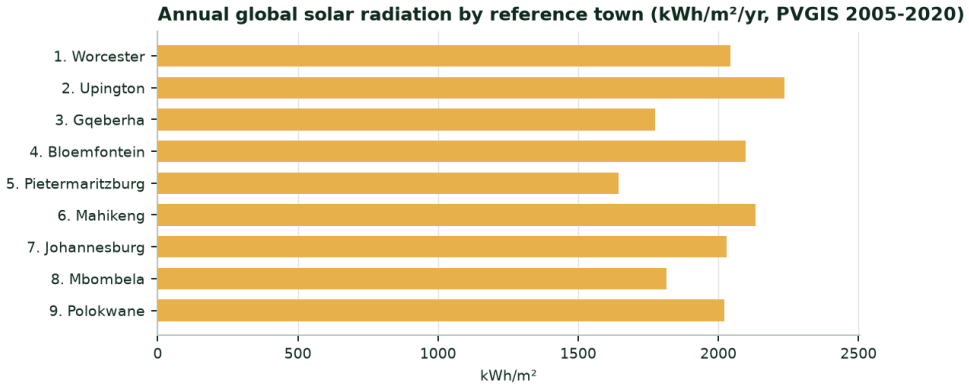


Figure 3. Annual global solar radiation in each reference town. Source: PVGIS (A8)

3.2 Rainfall and evapotranspiration

It rains 892 mm a year at Pietermaritzburg, but only 210 mm at Upington, where reference evapotranspiration reaches 2,231 mm. Rain falls in summer (October to March) in the east and interior, but in winter in the Western Cape, which has a Mediterranean climate. The west and the Northern Cape are arid, and farming there depends on the rivers.

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

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Worcester	24	21	27	33	38	60	59	51	35	35	35	24
Upington	35	30	36	24	12	5	4	3	5	14	13	28
Gqeberha	40	42	46	39	24	25	25	40	33	49	57	46
Bloemfontein	81	72	69	46	20	11	8	15	16	42	64	73
Pietermaritzburg	132	112	97	61	27	20	28	32	54	92	112	125
Mahikeng	87	88	71	39	18	9	3	7	13	43	66	85
Johannesburg	128	110	87	45	17	8	3	10	22	73	97	132
Mbombela	153	132	105	53	18	9	12	17	33	71	120	150
Polokwane	111	82	72	39	11	4	3	4	13	44	95	128

Source: ERA5 via Open-Meteo (A9); author's calculation.

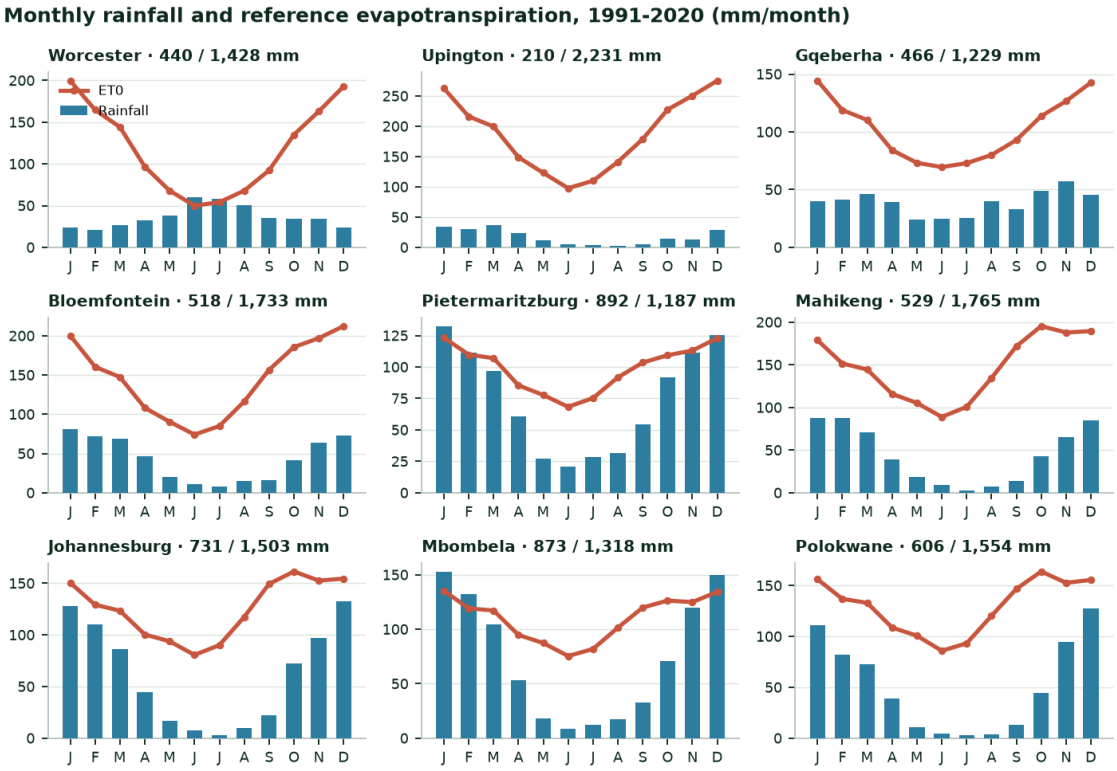


Figure 4. Monthly rainfall and reference evapotranspiration by city, 1991-2020. Source: ERA5 via Open-Meteo (A9)

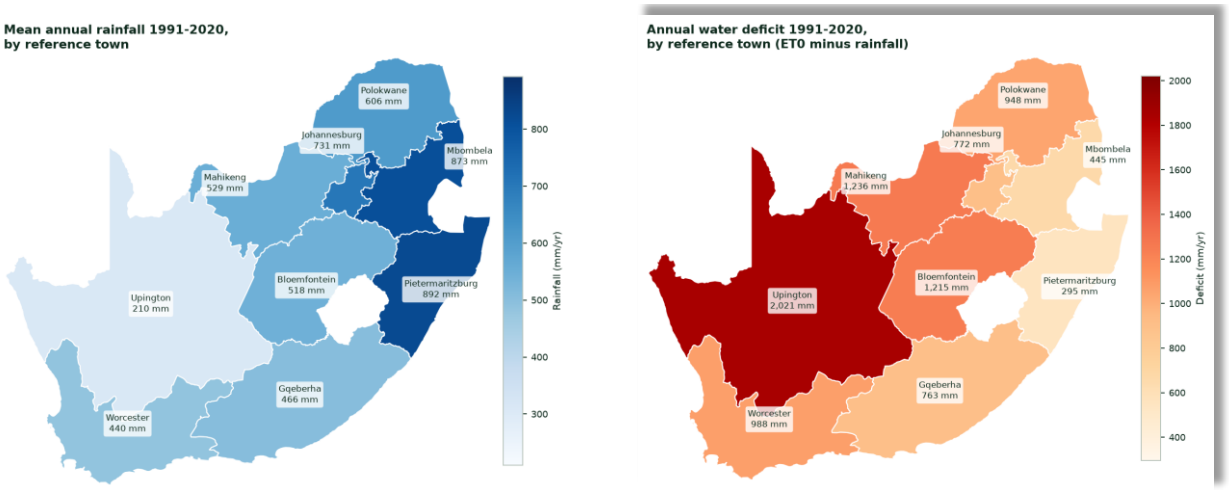


Figure 5. Mean annual rainfall 1991-2020, by region. Source: ERA5 (A9), Natural Earth (A10). *Annual water deficit, by region. Source: ERA5 (A9), Natural Earth (A10).*

3.3 Climate change

Mean annual temperature is rising. At Johannesburg it went from 14.1 °C in 1981 to 17.0 °C in 2024, a trend of 0.36 °C per decade. At Upington the trend is 0.12 °C per decade, from 20.8 °C to 22.6 °C. Warmer air dries the soil faster between two rains.

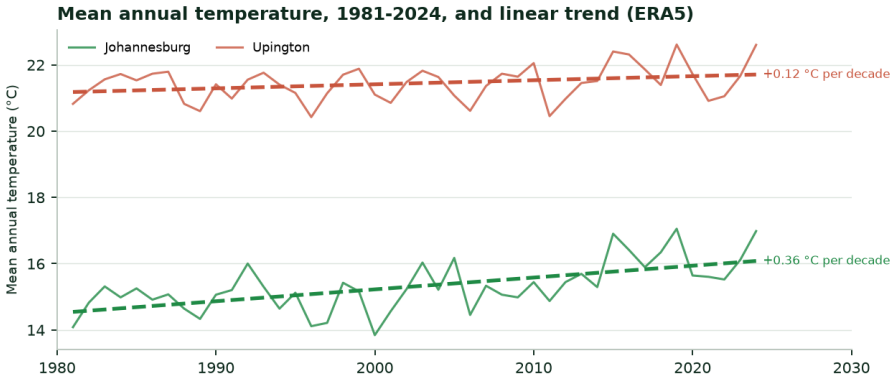


Figure 6. Mean annual temperature, 1981-2024, and linear trend. Source: ERA5 (A9)



The Cederberg mountains, in the Western Cape.

4. Water: Resources, irrigated areas, withdrawals

4.1 Resources and withdrawals

Total freshwater withdrawals are 21,110 million m³ a year (2022). Agriculture withdraws 59.4% of it, that is 12,539 Mm³. Internal resources are 44.8 km³ a year and water stress is 67.6%: The resource is already heavily used: Every cubic metre kept in the soil counts.

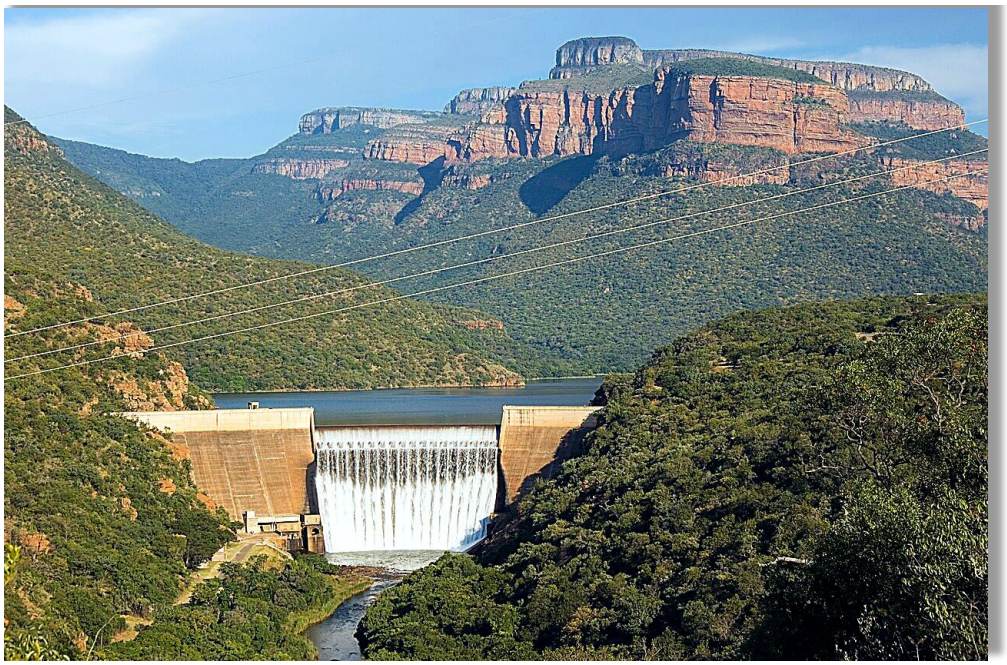
Freshwater: Withdrawals and resources

Indicator	Value	Year	Source
Total withdrawals	21,110 Mm³	2022	World Bank (A1)
Agricultural share	59.4%	2022	World Bank (A1)
Agricultural withdrawals	12,539.3 Mm³	2022	Calculated from A1
Area equipped for irrigation	2,239,760 ha	2024	FAOSTAT (A6)
Agricultural withdrawals per equipped hectare	5,599 m³/ha	—	Calculation (Annex B)
Water stress	67.6%	2022	World Bank (A1)

4.2 Irrigated areas

FAOSTAT counts 2,239,760 hectares equipped for irrigation in 2024. In 2012, the area equipped for irrigation reached 1,670,000 ha, of which 920,000 ha (55%) under sprinkler irrigation, centre pivots included

(A11). Irrigation is concentrated on the Orange, Vaal and Olifants rivers and the dams of the Western Cape, and the droughts of recent years showed that water is the first limit of farming there.



The Blyde River dam, in Mpumalanga.

4.3 What the water saving represents

In the central scenario, the saving is 1,519.4 million m³ a year, or 12.1% of agricultural withdrawals. At 5,599 m³ per equipped hectare, this water would irrigate about 271,400 more hectares, or 12.1% of today's equipped area.

5. Fertilisers: Quantities, purchases, spending

5.1 Quantities used

In 2024, agricultural use reaches 640,129 tonnes of nitrogen, 490,643 tonnes of phosphate (P2O5) and 312,403 tonnes of potash (K2O). The country produces 172,469 tonnes of nitrogen and 355,000 tonnes of phosphate (P2O5); it imported 640,129 tonnes of nitrogen in the same year. Per hectare of arable land, use is 120.3 kg per hectare.

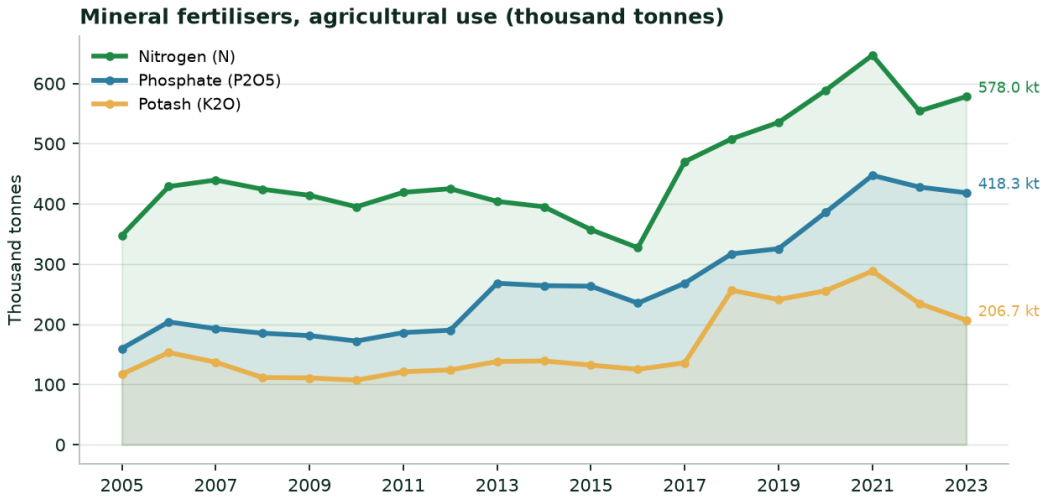


Figure 7. Mineral fertilisers, agricultural use, 2005-2023. Source: FAOSTAT (A5)

5.2 Regulatory framework

The 1947 Act provides for the registration of fertilisers with the Department of Agriculture, with regulations on registration and imports (A13). A water-retaining polymer would come under it according to its classification, to be confirmed with the registrar.



Potassium-deficient maize, at Cedara (KwaZulu-Natal).

5.3 Indicative spending

In 2024, the indicative minimum spending on mineral fertilisers reaches $1,131 million, at international fertiliser prices (calculation in Annex B, lower bound).

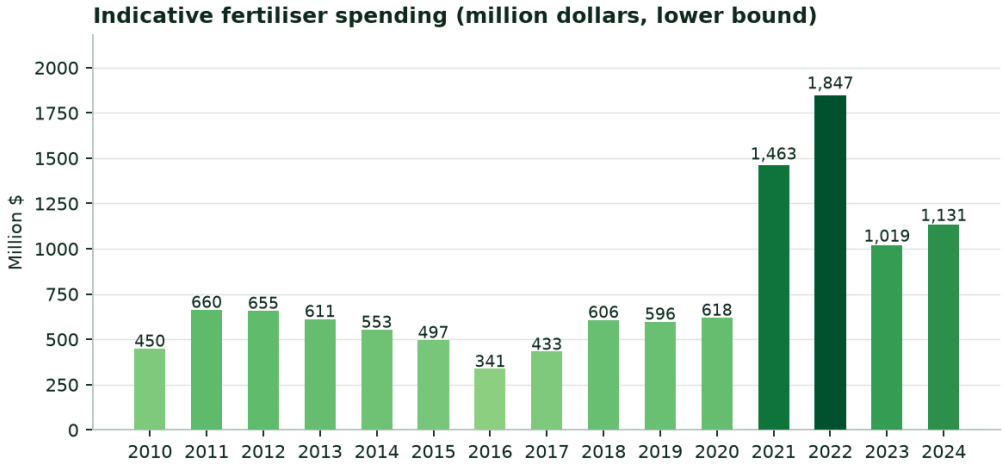


Figure 8. Indicative fertiliser spending, lower bound. Source: Author's calculation from A5 and A7

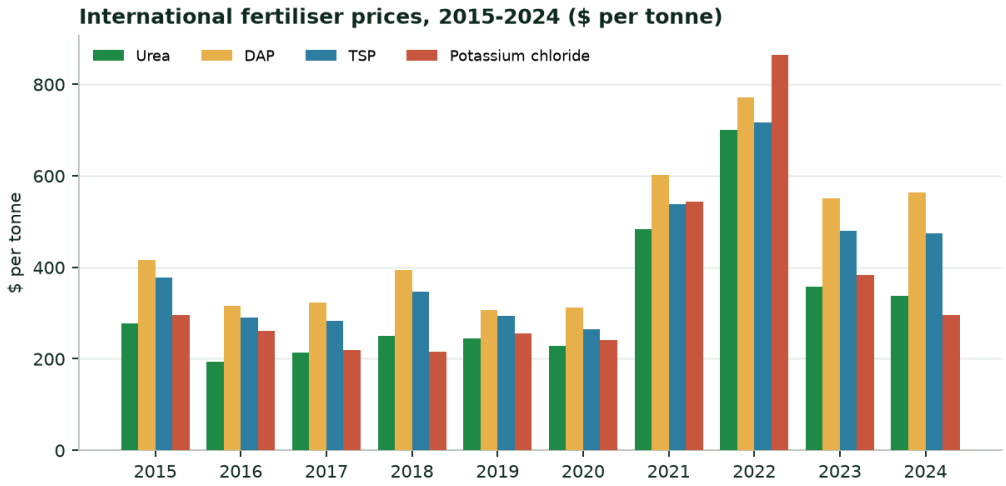


Figure 9. International prices of urea, DAP, TSP and potassium chloride. Source: World Bank, Pink Sheet (A7)

6. The regions at a glance

The table compares the nine provinces, 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)
Western Cape (Worcester)	440	1,428	988	2,044	18.0
Northern Cape (Upington)	210	2,231	2,021	2,235	21.5
Eastern Cape (Gqeberha)	466	1,229	763	1,773	18.1
Free State (Bloemfontein)	518	1,733	1,215	2,098	16.9
KwaZulu-Natal (Pietermaritzburg)	892	1,187	295	1,644	17.5
North West (Mahikeng)	529	1,765	1,236	2,134	18.7
Gauteng (Johannesburg)	731	1,503	772	2,030	15.4
Mpumalanga (Mbombela)	873	1,318	445	1,815	19.5
Limpopo (Polokwane)	606	1,554	948	2,022	18.0

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

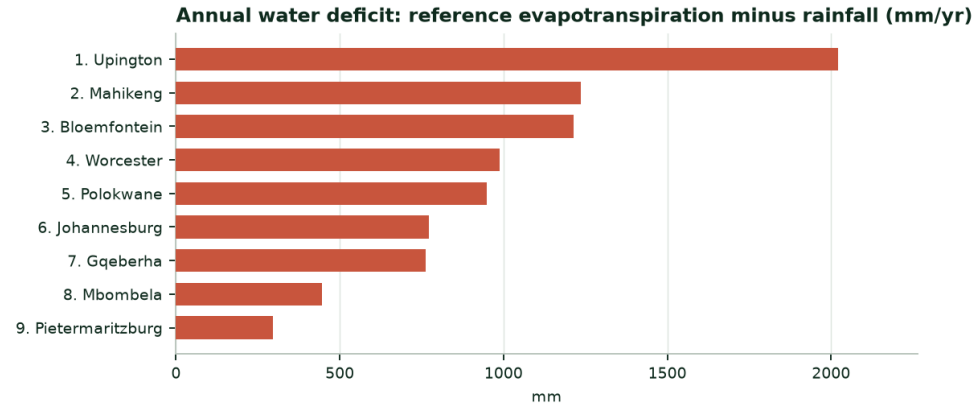


Figure 10. Annual water deficit: Reference evapotranspiration minus rainfall. Source: ERA5 (A9)



Centre pivots near Hartbeespoort (North West).

7. The twenty main crops: Three rankings

7.1 By harvested area

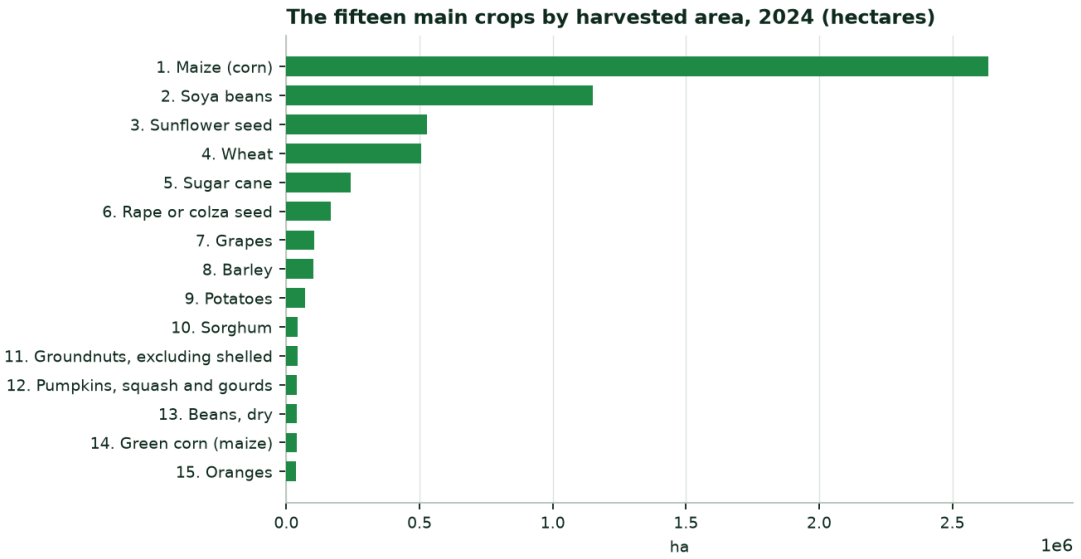


Figure 11. The fifteen main crops by harvested area, 2024 (hectares). Source: FAOSTAT (A2)

The ten main crops by area, 2024

Crop	Harvested area (ha)	Production (t)	Yield (t/ha)
Maize (corn)	2,636,250	12,850,000	4.87
Soya beans	1,150,500	1,848,000	1.61
Sunflower seed	529,000	632,000	1.19
Wheat	505,300	1,924,890	3.81
Sugar cane	242,267	16,741,000	69.10
Rape or colza seed	165,750	288,200	1.74
Grapes	103,955	1,870,973	18.00
Barley	100,700	374,000	3.71
Potatoes	69,129	2,623,499	37.95
Sorghum	42,100	98,000	2.33

Source: FAOSTAT (A2).

7.2 By production

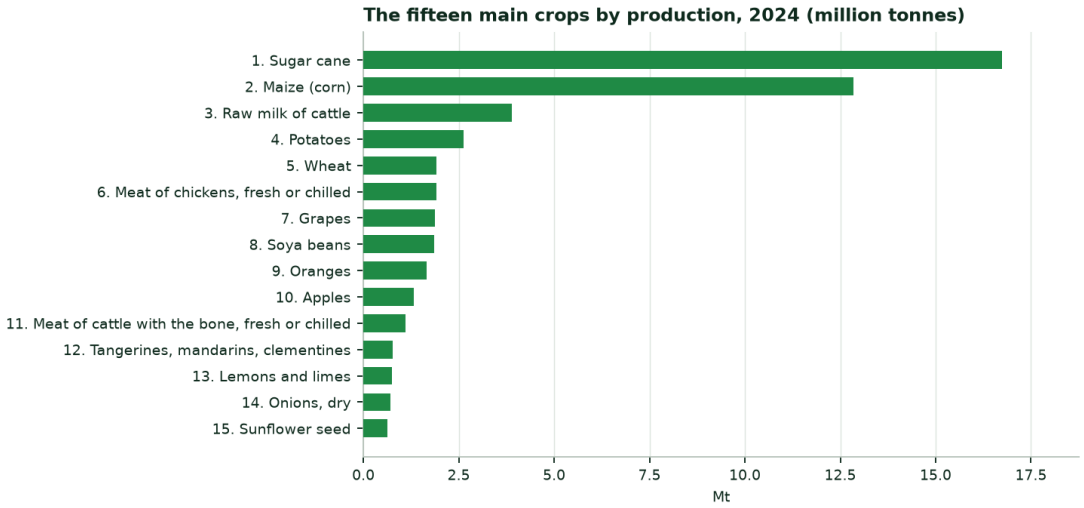


Figure 12. The fifteen main crops by production, 2024 (million tonnes). Source: FAOSTAT (A2)

7.3 By production value

By production value, the three main crops are: Maize (corn), grapes and soya beans (FAOSTAT, 2023, constant international dollars).

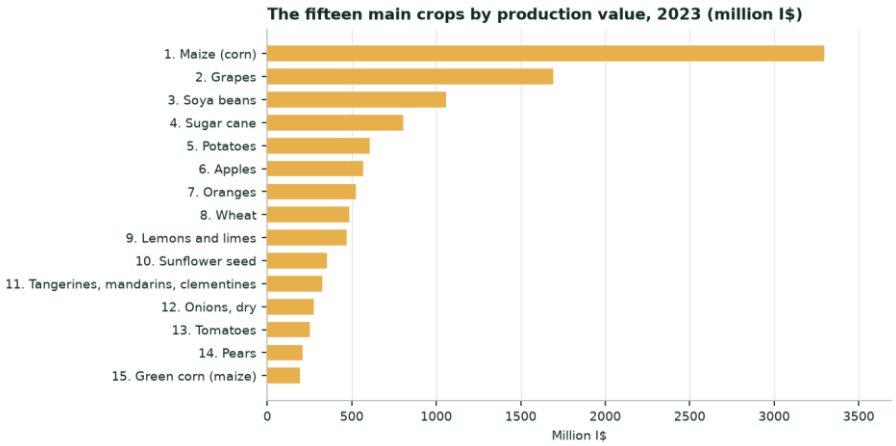


Figure 13. The fifteen main crops by production value, 2023 (million I$). Source: FAOSTAT (A3)



A potato field under a centre pivot, near Patensie (Eastern Cape).

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 and sweet potato, vines, citrus, other fruit, sugar cane, wheat and winter barley and other irrigated land), in proportion to their harvested areas; the equipped area is shared the same way.

• **Rainfed crops.** For crops that have a trial (maize and soybean), the production gain is calculated per 10,000 ha treated, at the national average 2024 yield.

• Each calculation applies the effect of the trial cited: A quarter (cautious), half (central), all of it (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: Yield
Soybean, China	Soybean	Assumption	+11.3%	Soybean: Yield
Watermelon, Mexico (2023)	Watermelon	-60.5%	+30.0%	Vegetables and melons: Water and yield
Potato, South Africa (2025)	Potato	-52.0%	+31.4%	Potato and sweet 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 South Africa: The figures below apply the trials cited to the country's average yields.

8.3 Rainfed crops: Maize and Soybean

Average 2024 yields (FAOSTAT): Maize 4.87 t/ha and soybean 1.61 t/ha. A water-retention polymer keeps the water of each rain near the roots and helps the crop through dry days during the season.

Extra production per 10,000 ha treated (tonnes a year)

Crop	Average yield (t/ha)	Cautious	Central	High
Maize	4.87	2,084	4,168	8,335
Soybean	1.61	454	908	1,815

Source: FAOSTAT (A2); trials A14 to A18; author's calculation (Annex B).

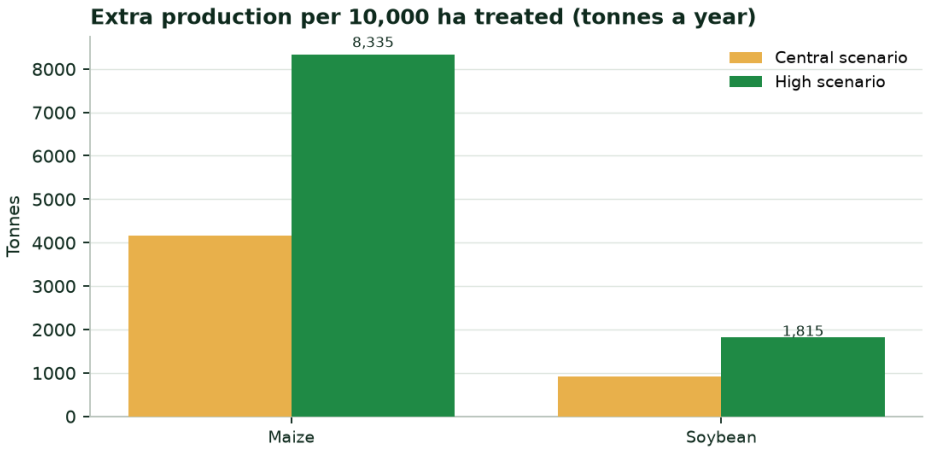


Figure 14. Extra production per 10,000 ha treated, central and high scenarios. Source: Author's calculation

8.4 Irrigation: Vegetables and melons, Potato and sweet potato, Vines and Citrus

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, squash, others)	158,016	7.1%	Watermelon, Mexico (2023)	267.6
Potato and sweet potato	96,414	4.3%	Potato, South Africa (2025)	140.3
Vines (table and wine grapes)	103,955	4.6%	Generic assumption, no trial	58.2
Citrus (orange, lemon, mandarin, grapefruit)	110,653	4.9%	Generic assumption, no trial	61.9
Other fruit (apple, pear, avocado, peach, pineapple, mango)	128,562	5.7%	Generic assumption, no trial	72.0
Sugar cane	242,267	10.8%	Generic assumption, no trial	135.6
Wheat and winter barley	638,782	28.5%	Generic assumption, no trial	357.6
Other irrigated land (lucerne, nuts, maize, fodder)	761,111	34.0%	Generic assumption, no trial	426.1

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	759.7	135,700	416,850
Central	1,519.4	271,400	833,700
High	3,038.9	542,801	1,667,400

Source: Author's calculation (Annex B).

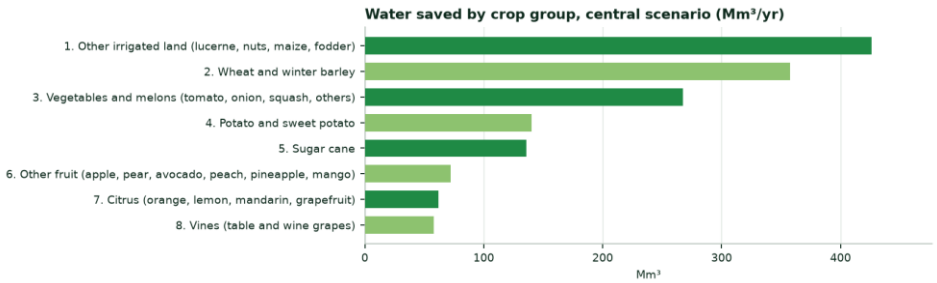


Figure 15. Water saved by crop group, central scenario. Source: Author's calculation

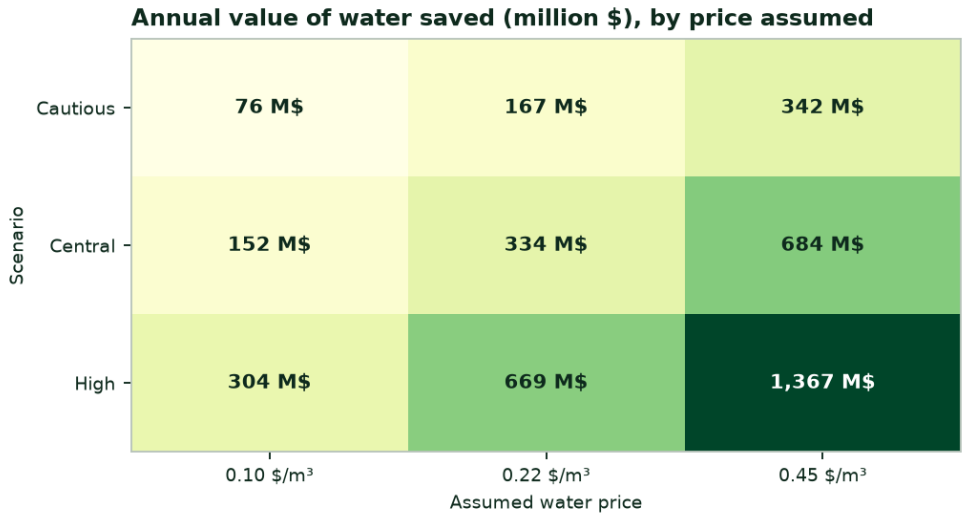


Figure 16. Annual value of the water saved, by price assumed per cubic metre. Source: Author's calculation; prices assumed, no national tariff

8.5 Reading the results

Key points

• The "other irrigated land" group gives 28% 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 their confidence level and their limit.

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 South Africa
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
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 South Africa

Source: Annex A.



Green fields at the foot of the Blyde River canyon (Mpumalanga).

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)	12,735	13,192
Agricultural imports (crops and livestock)	6,680	7,141
Exports, all merchandise	110,855	110,076
Imports, all merchandise	130,747	123,469

Source: FAOSTAT (A4).

10.2 Exports

The three main farm products exported in 2024 are: Maize (corn) ($863 million), grapes ($839 million) and oranges ($759 million).

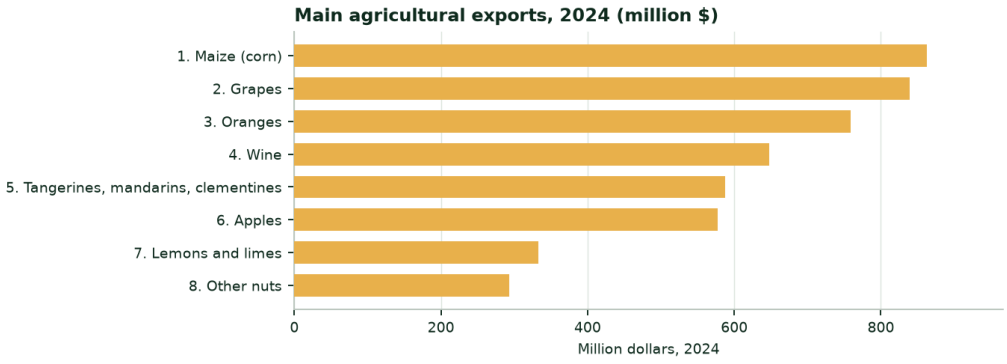


Figure 17. Main agricultural exports, 2024. Source: FAOSTAT (A4)

10.3 Imports

The main farm purchases are: Wheat ($538 million), palm oil ($501 million) and spirits ($356 million). Rice weighs $641 million (husked, broken and milled rice): Every tonne grown locally reduces this bill.

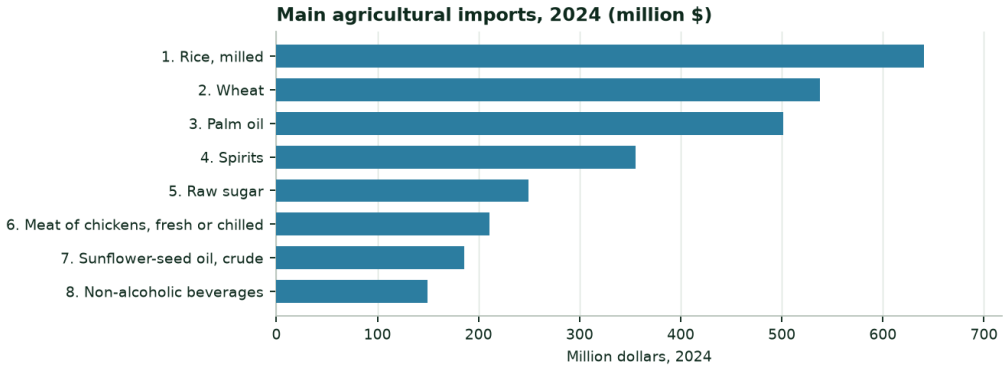


Figure 18. Main agricultural imports, 2024. Source: FAOSTAT (A4)



Figure 19. A grower shows her vegetables, in Gugulethu (Cape Town).



Women pack fresh vegetables in Gugulethu, Cape Town.

10.4 Importing water-retention polymers into South Africa

What to know

• **Customs duty (subheading 3906.90):** The general duty is 0% (free); line 3906.90.30, for liquids and pastes based on hydroxyl acrylic resin, is listed at 15%, which shows the rate depends on the exact line (A12).

• **Preferential agreements:** The European Union, the United Kingdom, EFTA, SADC, Mercosur and AfCFTA are listed at 0% for the subheading (A12).

• **Import VAT:** 15%, calculated on the customs value plus 10% for goods from outside the Southern African Customs Union, then plus the customs duty (A12).

• **Registration:** The 1947 Act provides for the registration of fertilisers with the Department of Agriculture (A13). No text specific to water-retaining agents was found: The classification of a water-retaining polymer (fertiliser, conditioner or other) is to be confirmed with the registrar of the Act.

• **Classification:** Code 3906.90 is an inference for our products; SARS 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 most short. The description of crops is qualitative.



Vineyards and farmland of Constantia, in Cape Town.

Western Cape (Worcester)

Winter rain, dry summers: Vines, pome fruit, citrus and wheat, in valleys irrigated from dams that fill in winter; the country's largest fruit hub.

Indicator	Value
Annual rainfall, 1991-2020	440 mm
Reference evapotranspiration	1,428 mm
Annual water deficit	988 mm
Months with less than 50 mm of rain	9
Global solar radiation	2,044 kWh/m²
Mean temperature	18.0 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

Northern Cape (Upington)

Desert and semi-desert along the Orange River: Table grapes, dates, pecan and lucerne, entirely irrigated from the river; sheep farming inland.

Indicator	Value
Annual rainfall, 1991-2020	210 mm
Reference evapotranspiration	2,231 mm
Annual water deficit	2,021 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,235 kWh/m²
Mean temperature	21.5 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

Eastern Cape (Gqeberha)

Transition between winter and summer rain: Citrus of the Sundays River valley, chicory, livestock and the small farms of the former Transkei.

Indicator	Value
Annual rainfall, 1991-2020	466 mm
Reference evapotranspiration	1,229 mm

Indicator	Value
Annual water deficit	763 mm
Months with less than 50 mm of rain	11
Global solar radiation	1,773 kWh/m²
Mean temperature	18.1 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

Free State (Bloemfontein)

Interior with summer rain: Maize, soybean, wheat, sunflower and livestock on large farms, with centre pivots along the Vaal River.

Indicator	Value
Annual rainfall, 1991-2020	518 mm
Reference evapotranspiration	1,733 mm
Annual water deficit	1,215 mm
Months with less than 50 mm of rain	7
Global solar radiation	2,098 kWh/m²
Mean temperature	16.9 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

KwaZulu-Natal (Pietermaritzburg)

Humid coast and hills: Sugar cane, forestry, vegetables, macadamia and dairy farming, with abundant summer rain.

Indicator	Value
Annual rainfall, 1991-2020	892 mm
Reference evapotranspiration	1,187 mm
Annual water deficit	295 mm
Months with less than 50 mm of rain	4
Global solar radiation	1,644 kWh/m²
Mean temperature	17.5 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

North West (Mahikeng)

Dry western Highveld: Maize, sunflower, cattle and centre-pivot irrigation along the Vaal River and in the Vaalharts scheme.

Indicator	Value
Annual rainfall, 1991-2020	529 mm
Reference evapotranspiration	1,765 mm
Annual water deficit	1,236 mm
Months with less than 50 mm of rain	7
Global solar radiation	2,134 kWh/m²
Mean temperature	18.7 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

Gauteng (Johannesburg)

The most urban province: Peri-urban vegetables, poultry and flowers around Johannesburg and Pretoria, on shrinking land.

Indicator	Value
Annual rainfall, 1991-2020	731 mm
Reference evapotranspiration	1,503 mm
Annual water deficit	772 mm
Months with less than 50 mm of rain	6
Global solar radiation	2,030 kWh/m²
Mean temperature	15.4 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

Mpumalanga (Mbombela)

The Lowveld and eastern Highveld: Citrus, banana, litchi, avocado, sugar cane and maize, irrigated in the Crocodile River valley.

Indicator	Value
Annual rainfall, 1991-2020	873 mm
Reference evapotranspiration	1,318 mm
Annual water deficit	445 mm
Months with less than 50 mm of rain	5
Global solar radiation	1,815 kWh/m²
Mean temperature	19.5 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

Limpopo (Polokwane)

The hot north: Tomato, mango, citrus, avocado, potato and cattle, with irrigation increasingly needed.

Indicator	Value
Annual rainfall, 1991-2020	606 mm
Reference evapotranspiration	1,554 mm
Annual water deficit	948 mm
Months with less than 50 mm of rain	7
Global solar radiation	2,022 kWh/m²
Mean temperature	18.0 °C

Source: ERA5 via Open-Meteo (A9); PVGIS (A8); author's calculation.

Annex A. Sources and confidence levels

Ref.	Source	Level
A1	World Bank, World Development Indicators (WDI), South Africa	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

Ref.	Source	Level
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	ERA5 (Copernicus), via Open-Meteo: Rainfall, reference evapotranspiration, temperature, 1981-2024	B
A10	Natural Earth, first-level administrative boundaries and country outline	B
A11	FAO, AQUASTAT, country profile South Africa: Area equipped for irrigation and irrigation techniques (2012 data)	A
A12	South African customs tariff (Schedule 1 Part 1), subheading 3906.90, as listed by JLog (SARS-licensed customs clearing agent): General duty, preferential duties and import VAT; line 3906.90.30 is listed at 15%	C
A13	Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947), and its registration regulations; Department of Agriculture	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
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 (21,110 Mm³, 2022) × agricultural share (59.40%) = 12,539.3 Mm³.

2. Irrigation. The equipped area (2,239,760 ha) and agricultural water are shared between irrigated groups (vegetables and melons, potato and sweet potato, vines, citrus, other fruit, sugar cane, wheat and winter barley and other irrigated land) in proportion to their harvested areas (2,239,760 ha), without exceeding each group's harvested area. Our sources have no irrigation statistic 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 irrigable crops retained: The difference forms an "other irrigated land" group (lucerne, nuts, maize, fodder), with the generic assumption. Maize, soybean, sunflower and barley are otherwise treated as rainfed for the rest of their area.

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

4. Extra hectares. Water saved ÷ water per equipped hectare (5,599 m³/ha).

5. Rainfed crops. Gain per 10,000 ha = 10,000 × average 2024 yield (production ÷ harvested area, FAOSTAT) × trial effect on yield (maize 17.1% and soybean 11.3%), with the same quarter, half and whole.

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 ERA5 grid cell containing each city; radiation: PVGIS, 2005-2020. Temperature trends are linear regressions over 1981-2024. ERA5 is a reanalysis: Its rainfall can differ from local station records. On the maps, each province 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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Die Mas vineyard, Wine Route, Upington, Northern Cape, South Africa (1	South African Tourism from South Africa	CC BY 2.0
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The Blaauklippen vineyard, in Stellenbosch.

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