

COUNTRY DOSSIER

Egypt

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

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Farmers in a wheat field, in the shade of palm trees.

Foreword

This dossier describes Egypt 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, Egyptian public bodies (CAPMAS, Ministry of Agriculture and Land Reclamation)).
- **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 Egypt.

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Summary

The points below summarise the dossier. The figures come from public sources: The World Bank, FAO (FAOSTAT, AQUASTAT), Egyptian public bodies (CAPMAS, Ministry of Agriculture and Land Reclamation), PVGIS and ERA5. The production gains and water savings are scenarios, described in Annex B.

118.37 M
Inhabitants in 2025 (World Bank)

1.39 M ha
Of wheat harvested in 2024, the main crop

4.01 M ha
Equipped for irrigation (2024)

9,469 Mm³
Of irrigation water saved a year, central scenario

10,014 M$
Of agricultural exports in 2024 (FAOSTAT)

Key points

- **Irrigation, a pillar of production.** 4.01 million hectares equipped for irrigation in 2024, or 95% of the 4.23 million hectares of cropland.
- **Wheat: The main crop.** 1,386,892 ha harvested in 2024, for 9.40 million tonnes, or 6.78 t/ha.
- **Water is scarce.** National water stress reaches 141.2%; at Assouan, the air demands 2,938 mm more than it rains.
- **In irrigation, the water saved enlarges the schemes.** 9,469.0 Mm³ a year in the central scenario, enough to irrigate about 619,489 more ha, or 15.4% of the equipped area.
- **An organic chain.** 115,490 ha of certified organic cropland in 2024: ECOFERT® is EU Bio certified.
- **Fertilisers made locally.** 1,586,809 t of nitrogen used in 2024; the country produces 3,198,000 t and imports 23,852 t.
- **Farm trade.** $10,014 million of exports and $18,981 million of imports in 2024. First sale: Oranges ($893 million). First purchase: Wheat ($4,443 million).

Key figures

Key indicators for Egypt

Indicator	Value	Year	Source (level)
Population	118.37 M	2025	World Bank (A1)
GDP per capita	3,086 $	2025	World Bank (A1)
Agriculture share of GDP	16.6%	2025	World Bank (A1)
Agricultural employment	17.5%	2025	World Bank (A1)
Cropland	4,229,000 ha	2024	FAOSTAT (A6)
Area equipped for irrigation	4,013,710 ha	2024	FAOSTAT (A6)
Harvested area: Wheat	1,386,892 ha	2024	FAOSTAT (A2)
Certified organic cropland	115,490 ha	2024	FAOSTAT (A6)
Agricultural exports	10,014 M$	2024	FAOSTAT (A4)
Agricultural imports	18,981 M$	2024	FAOSTAT (A4)

Indicator	Value	Year	Source (level)
Mineral nitrogen, agricultural use	1,586,809 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 Egypt. 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.

2. Egypt in figures

Egypt had 118.37 million inhabitants in 2025, 57% of them in rural areas. Agriculture accounts for 16.6% of gross domestic product and employs 18% of the labour force. The country covers 995.5 thousand km², of which 4% is agricultural land. Undernourishment affects 8.4% of the population.

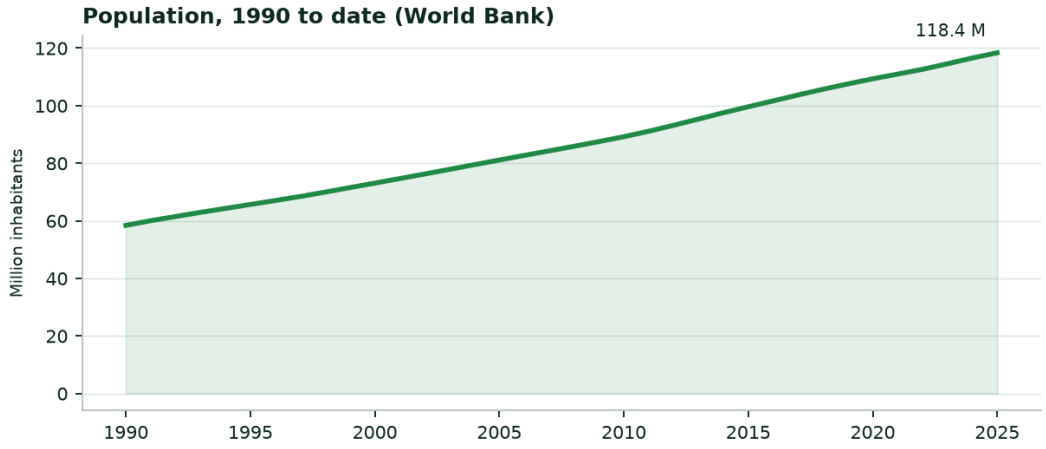


Figure 1. Population of Egypt, 1990 to date. Source: World Bank (A1)

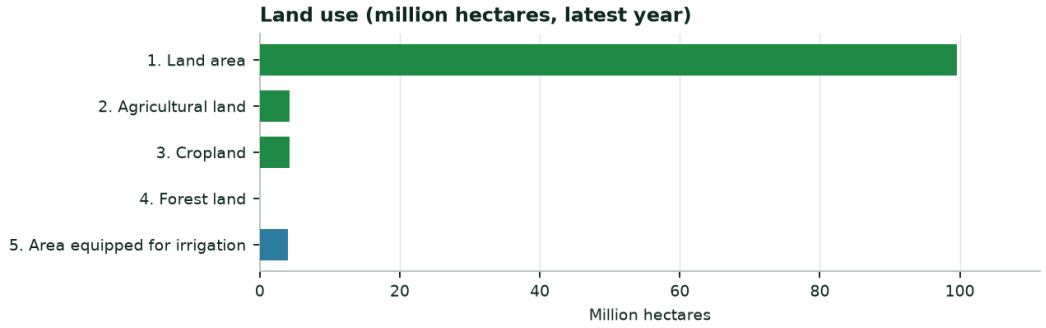


Figure 2. Land use, latest year published. Source: FAOSTAT (A6)

Agricultural and water indicators, latest year published

Indicator	Value	Year	Source
Cropland certified organic	115,490 ha	2024	FAOSTAT (A6)
Average cereal yield	7,360 kg/ha	2024	World Bank (A1)
Fertiliser use per hectare of arable land	597.8 kg/ha	2024	World Bank (A1)
Water withdrawals, agricultural share	79.2%	2022	World Bank (A1)
Internal freshwater resources	1.0 km³	2022	World Bank (A1)
Internal resources per inhabitant	9 m³	2022	World Bank (A1)



Strawberry harvest in Egypt.

3. Sunshine, rainfall and climate change

3.1 Sunshine

Global solar radiation reaches 2,101 to 2,440 kWh/m² a year depending on the region. Energy is not the limit: Water available at the right time makes the harvest.

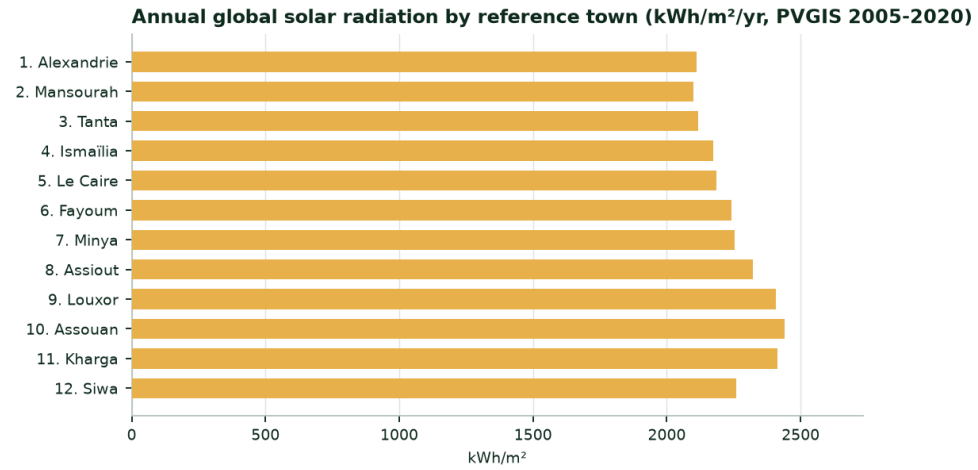


Figure 3. Annual global solar radiation in each reference town. Source: PVGIS (A8)

3.2 Rainfall and evapotranspiration

It rains 95 mm a year at Alexandrie, but only 2 mm at Assouan, where reference evapotranspiration reaches 2,940 mm. Rain is almost limited to the north coast, between autumn and spring; further south it is negligible and farming lives on irrigation. Summer is hot everywhere and the heat of Upper Egypt is the strongest.

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

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alexandrie	24	16	11	3	1	0	0	0	1	6	14	19
Mansourah	8	9	7	3	1	0	0	0	0	3	6	4
Tanta	7	7	6	2	1	0	0	0	0	2	4	4
Ismaïlia	4	4	6	2	1	0	0	0	0	2	2	3

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Le Caire	4	4	4	1	0	0	0	0	0	1	2	2
Fayoum	2	2	3	0	0	0	0	0	0	0	1	1
Minya	1	1	2	0	0	0	0	0	0	0	1	1
Assiout	1	0	2	0	0	0	0	0	0	0	1	0
Louxor	1	0	0	0	0	0	0	0	0	0	0	1
Assouan	0	0	0	0	0	0	0	0	0	0	0	0
Kharga	0	0	1	0	0	0	0	0	0	0	0	0
Siwa	2	3	2	1	0	0	0	0	0	0	0	2

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

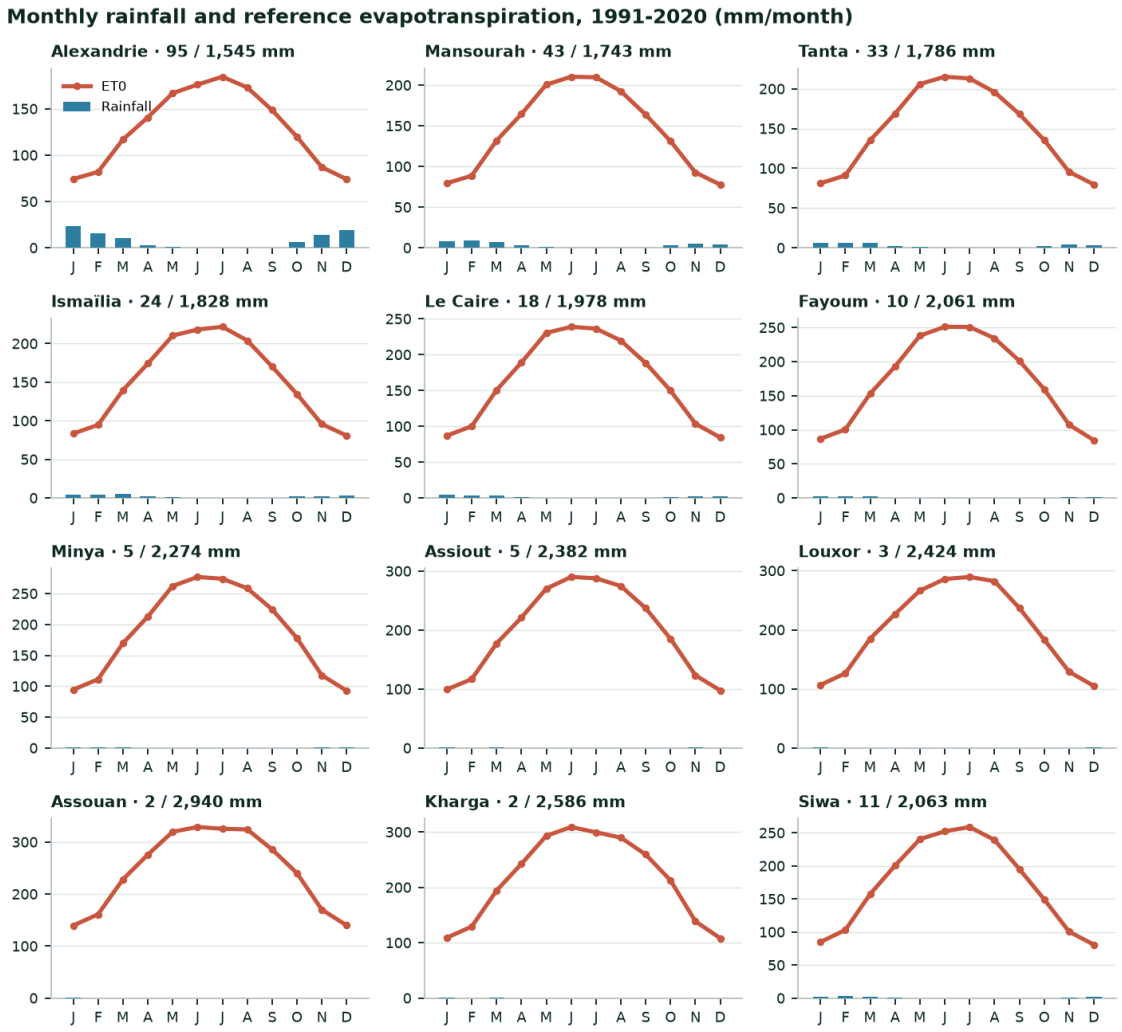


Figure 4. Monthly rainfall and reference evapotranspiration by city, 1991-2020. Source: ERA5 via Open-Meteo (A9)

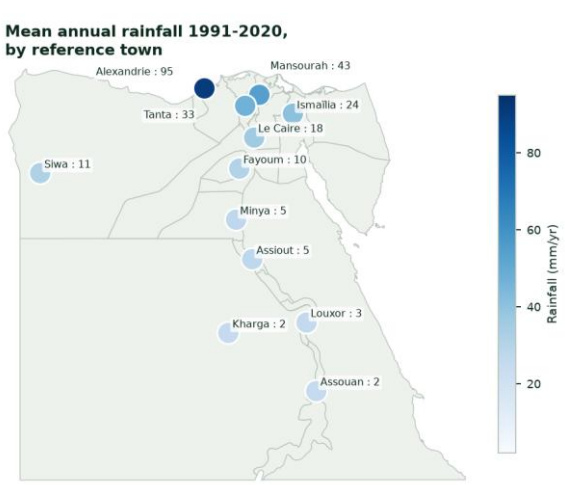
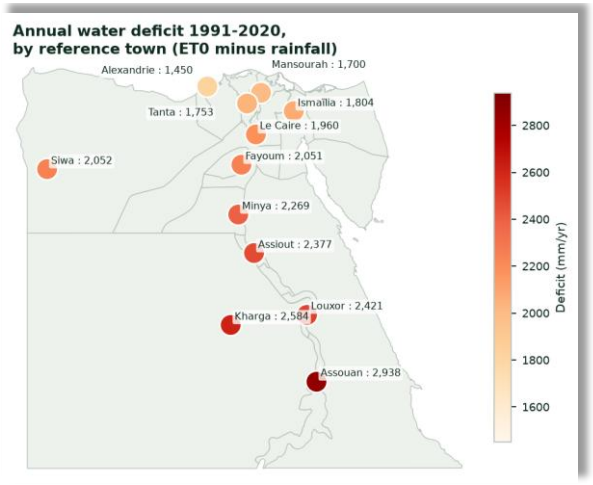


Figure 5. Mean annual rainfall 1991-2020, by region. Source: ERA5 (A9), Natural Earth (A10).



Annual water deficit, by region. Source: ERA5 (A9), Natural Earth (A10).

3.3 Climate change

Mean annual temperature is rising. At Le Caire it went from 21.3 °C in 1981 to 24.2 °C in 2024, a trend of 0.59 °C per decade. At Assouan the trend is 0.39 °C per decade, from 25.9 °C to 27.5 °C. Warmer air dries the soil faster between two rains.

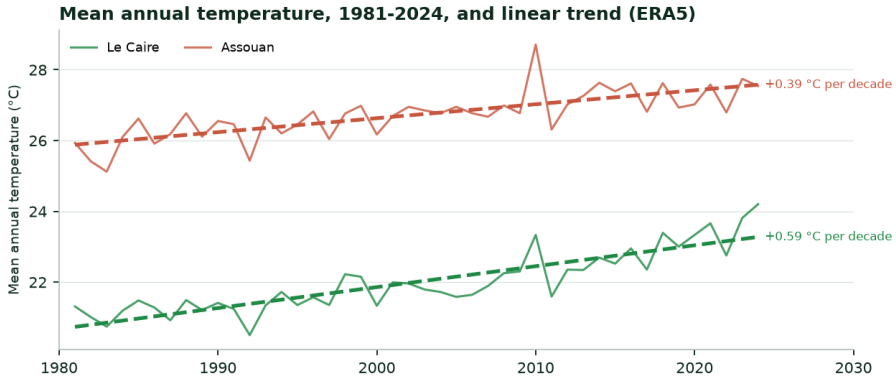


Figure 6. Mean annual temperature, 1981-2024, and linear trend. Source: ERA5 (A9)



Date palms in the Egyptian countryside, in the late afternoon.

4. Water: Resources, irrigated areas, withdrawals

4.1 Resources and withdrawals

Total freshwater withdrawals are 77,500 million m³ a year (2022). Agriculture withdraws 79.2% of it, that is 61,350 Mm³. Internal resources are 1.0 km³ a year and water stress is 141.2%: The resource is already heavily used: Every cubic metre kept in the soil counts.

Freshwater: Withdrawals and resources

Indicator	Value	Year	Source
Total withdrawals	77,500 Mm³	2022	World Bank (A1)
Agricultural share	79.2%	2022	World Bank (A1)
Agricultural withdrawals	61,350.0 Mm³	2022	Calculated from A1
Area equipped for irrigation	4,013,710 ha	2024	FAOSTAT (A6)
Agricultural withdrawals per equipped hectare	15,285 m³/ha	—	Calculation (Annex B)
Water stress	141.2%	2022	World Bank (A1)

4.2 Irrigated areas

FAOSTAT counts 4,013,710 hectares equipped for irrigation in 2024. FAO estimated the irrigation potential at 4,435,000 ha in 1993, for 3,246,000 ha equipped, of which 3,046,000 ha under surface irrigation (A11). Egypt receives 55.5 km³ a year from the Nile under the 1959 agreement with Sudan (A11). Water is therefore a quantity fixed by treaty: Hectares won from the desert are paid for with water saved elsewhere.



The Aswan High Dam, which controls the Nile floods.

4.3 What the water saving represents

In the central scenario, the saving is 9,469.0 million m³ a year, or 15.4% of agricultural withdrawals. At 15,285 m³ per equipped hectare, this water would irrigate about 619,489 more hectares, or 15.4% of today's equipped area.

5. Fertilisers: Quantities, purchases, spending

5.1 Quantities used

In 2024, agricultural use reaches 1,586,809 tonnes of nitrogen, 230,114 tonnes of phosphate (P2O5) and 140,200 tonnes of potash (K2O). The country produces 3,198,000 tonnes of nitrogen and 230,114 tonnes of phosphate (P2O5); it imported 23,852 tonnes of nitrogen in the same year. Per hectare of arable land, use is 597.8 kg per hectare.

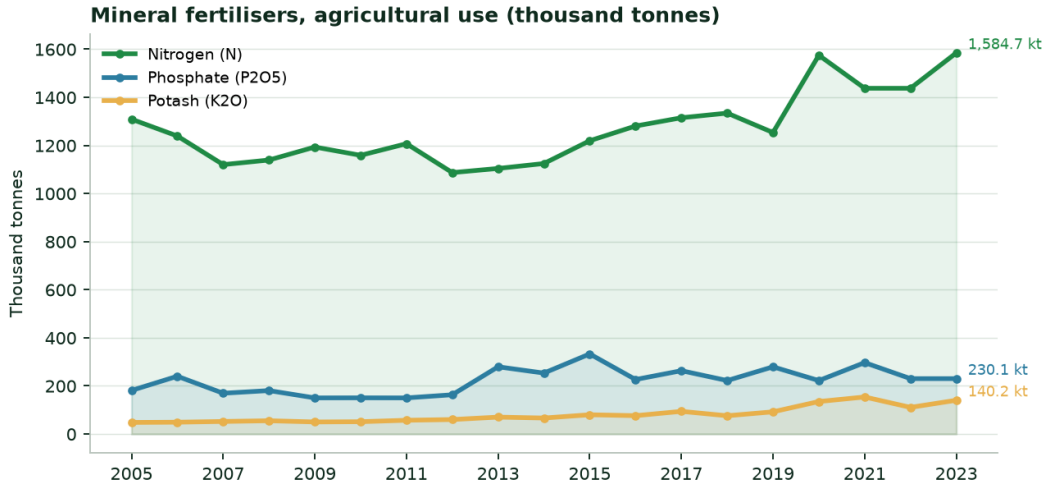


Figure 7. Mineral fertilisers, agricultural use, 2005-2023. Source: FAOSTAT (A5)

5.2 Regulatory framework

A fertiliser and soil conditioner control department exists at the Soil, Water and Environment Research Institute, and the Egyptian standards body publishes standards in the field (A13). The exact registration procedure for a water-retaining polymer was not found.



A farmer in his vegetable field, on an overcast day.

5.3 Indicative spending

In 2024, the indicative minimum spending on mineral fertilisers reaches $1,473 million, at international fertiliser prices (calculation in Annex B, lower bound).

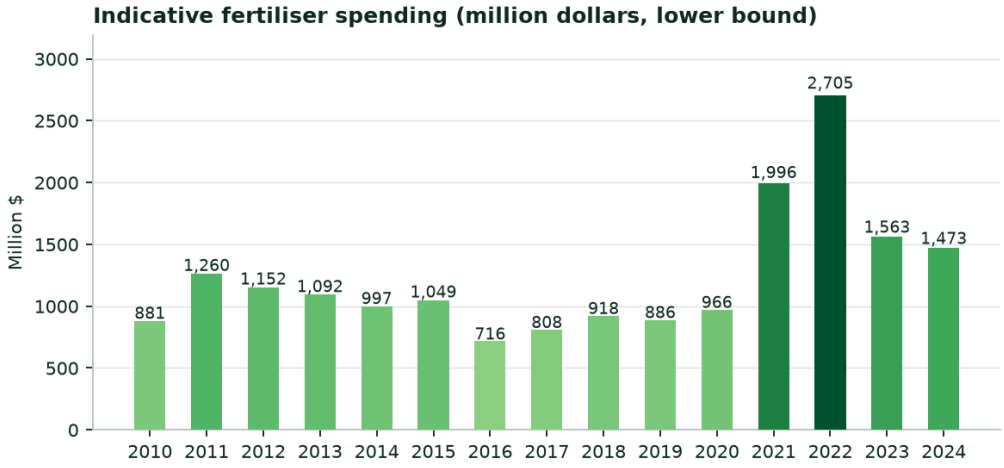


Figure 8. Indicative fertiliser spending, lower bound. Source: Author's calculation from A5 and A7

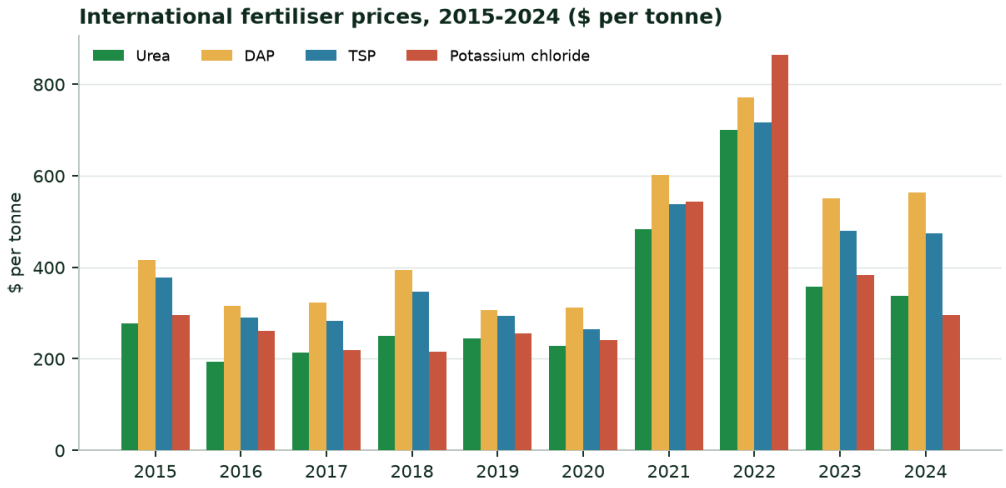


Figure 9. International prices of urea, DAP, TSP and potassium chloride. Source: World Bank, Pink Sheet (A7)

6. The regions at a glance

The table compares twelve reference towns, from the Mediterranean coast to Aswan. 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)
Alexandria (Alexandrie)	95	1,545	1,450	2,110	20.5
Mansoura (Mansourah)	43	1,743	1,700	2,101	21.3
Tanta (Tanta)	33	1,786	1,753	2,116	21.4
Ismailia (Ismaïlia)	24	1,828	1,804	2,175	21.3
Cairo (Le Caire)	18	1,978	1,960	2,186	22.0
Faiyum (Fayoum)	10	2,061	2,051	2,241	22.7
Minya (Minya)	5	2,274	2,269	2,254	23.1

Region (city)	Rainfall (mm/yr)	ET0 (mm/yr)	Deficit (mm/yr)	Radiation (kWh/m²/yr)	Temperature (°C)
Asyut (Assiout)	5	2,382	2,377	2,323	23.8
Luxor (Louxor)	3	2,424	2,421	2,406	25.3
Aswan (Assouan)	2	2,940	2,938	2,440	26.8
Kharga (Kharga)	2	2,586	2,584	2,414	23.7
Siwa (Siwa)	11	2,063	2,052	2,260	21.7

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

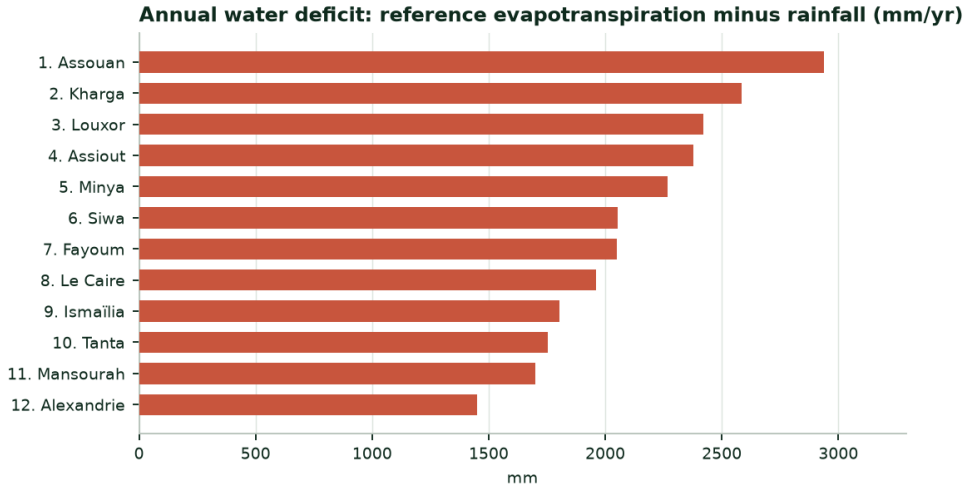


Figure 10. Annual water deficit: Reference evapotranspiration minus rainfall. Source: ERA5 (A9)



A palm grove in Upper Egypt, by the river.

7. The twenty main crops: Three rankings

7.1 By harvested area

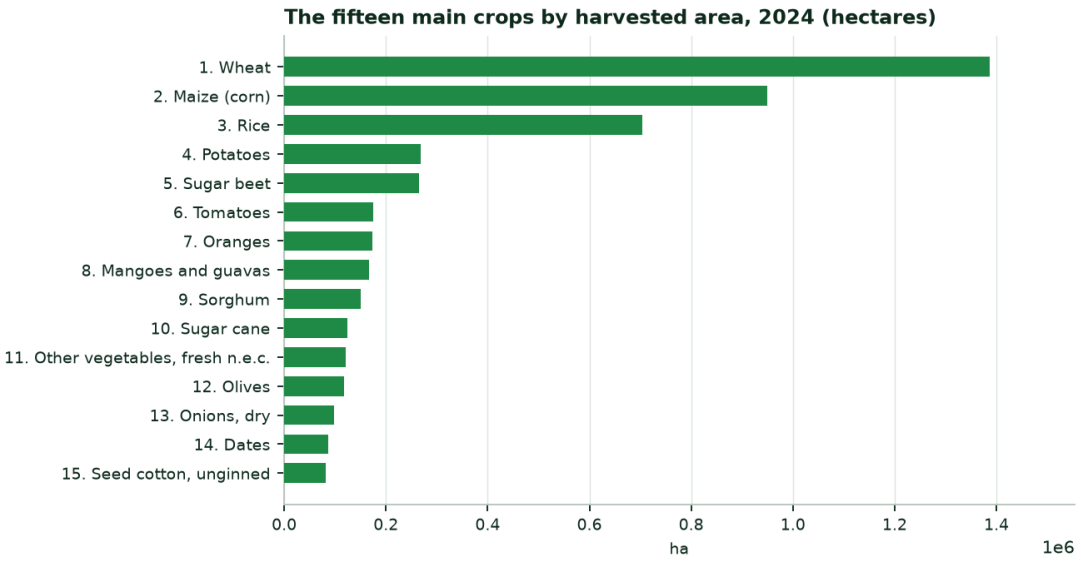


Figure 11. The fifteen main crops by harvested area, 2024 (hectares). Source: FAOSTAT (A2)

The ten main crops by area, 2024

Crop	Harvested area (ha)	Production (t)	Yield (t/ha)
Wheat	1,386,892	9,400,000	6.78
Maize (corn)	950,000	7,206,000	7.59
Rice	704,158	6,430,000	9.13
Potatoes	268,565	8,082,291	30.09
Sugar beet	264,840	13,880,842	52.41
Tomatoes	175,397	7,521,071	42.88
Oranges	173,711	4,200,000	24.18
Mangoes and guavas	167,276	1,863,396	11.14
Sorghum	150,000	780,000	5.20
Sugar cane	124,299	13,314,260	107.11

Source: FAOSTAT (A2).

7.2 By production

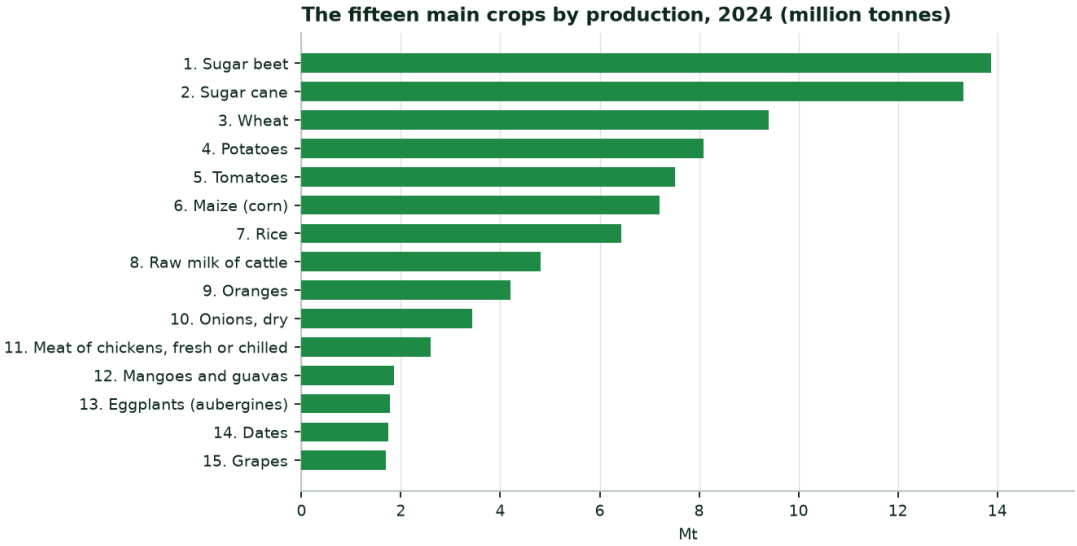


Figure 12. The fifteen main crops by production, 2024 (million tonnes). Source: FAOSTAT (A2)

7.3 By production value

By production value, the three main crops are: Tomatoes, rice and wheat (FAOSTAT, 2023, constant international dollars).

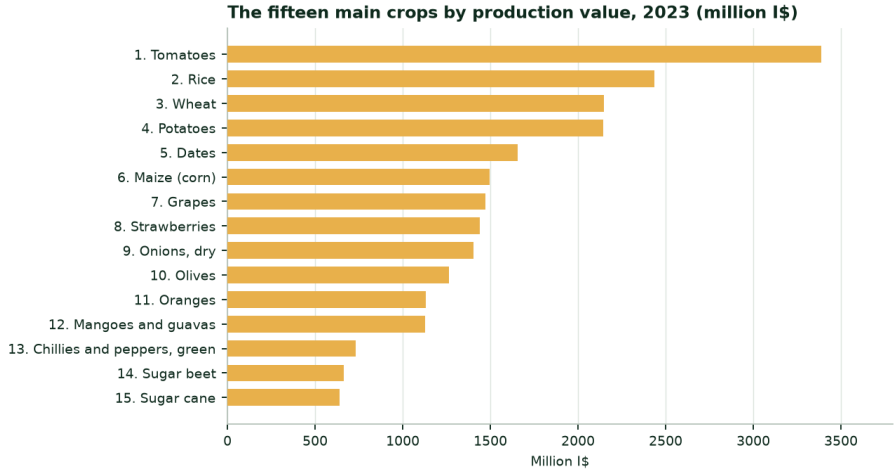


Figure 13. The fifteen main crops by production value, 2023 (million I$). Source: FAOSTAT (A3)



Sugar cane harvest.

8. Extrapolation by crop: Irrigation and rainfed crops

8.1 Method

Method in brief

• **Irrigation.** National agricultural water is shared between irrigated crops (wheat, barley, sorghum, maize, rice, sugar cane and sugar beet, potato, vegetables and melons, citrus, date palm, other fruit, cotton, groundnut, sesame, sunflower, soybean and pulses), 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), 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: 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%	Date palm: Water and yield

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

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

8.3 Irrigation: Wheat, barley, sorghum, Maize, Rice and Sugar cane and sugar beet

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

Crop group	Equipped area (ha)	Share	Trial or assumption	Water saved (Mm³/yr)
Wheat, barley, sorghum	1,097,429	27.3%	Generic assumption, no trial	1,677.4
Maize	648,857	16.2%	Maize, Türkiye (TIGEM, 2025)	1,934.0
Rice	480,945	12.0%	Generic assumption, no trial	735.1
Sugar cane and sugar beet	265,785	6.6%	Generic assumption, no trial	406.3
Potato	191,620	4.8%	Potato, South Africa (2025)	761.5
Vegetables and melons (tomato, onion, pepper, others)	531,455	13.2%	Watermelon, Mexico (2023)	2,457.3
Citrus (orange, mandarin, lemon)	168,291	4.2%	Generic assumption, no trial	257.2
Date palm	58,703	1.5%	Date palm, UAE (ICBA, 2021)	367.9
Other fruit (mango, olive, grape, banana, apple, fig)	335,085	8.3%	Generic assumption, no trial	512.2
Cotton, groundnut, sesame, sunflower, soybean	178,075	4.4%	Generic assumption, no trial	272.2
Pulses (bean, broad bean, lentil, chickpea)	57,464	1.4%	Generic assumption, no trial	87.8

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	4,734.5	309,745	1,800,785
Central	9,469.0	619,489	3,601,569
High	18,937.9	1,238,979	7,203,139

Source: Author's calculation (Annex B).

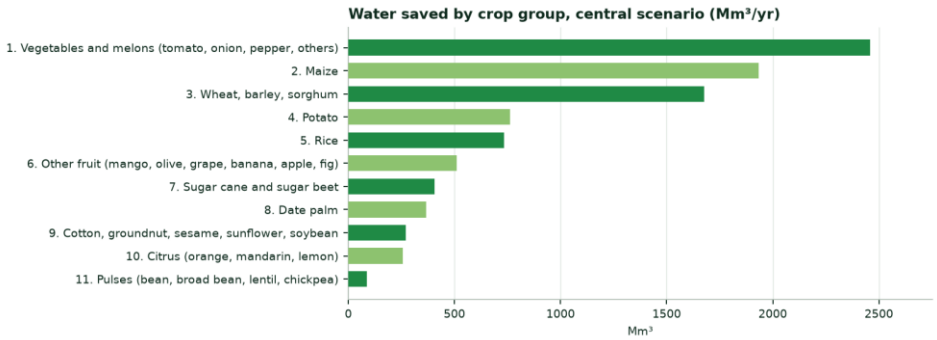


Figure 14. Water saved by crop group, central scenario. Source: Author's calculation

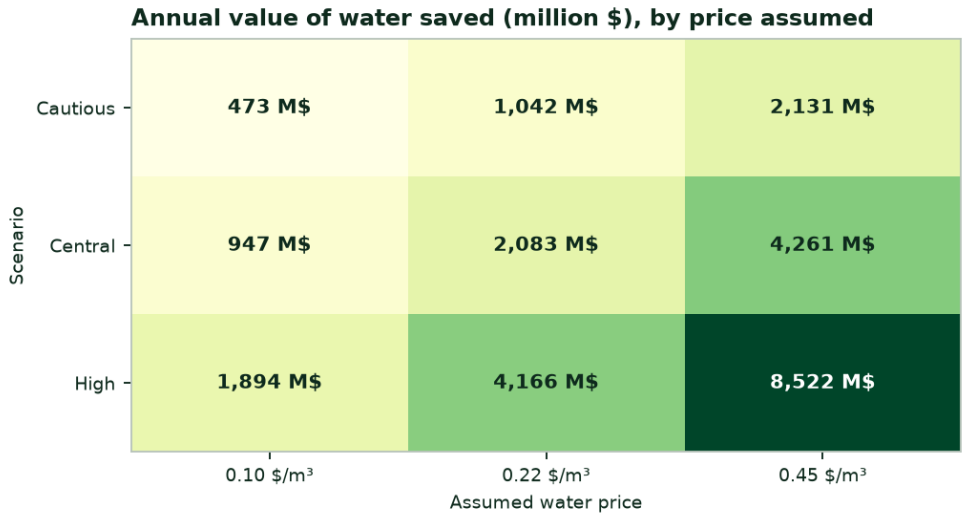


Figure 15. Annual value of the water saved, by price assumed per cubic metre. Source: Author's calculation; prices assumed, no national tariff

8.4 Reading the results

Key points

• The "vegetables and melons" group gives 26% of the irrigation water saving (watermelon, Mexico (2023)).

• 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 Egypt
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 Egypt

Source: Annex A.



A farmer in a green wheat field.

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)	8,732	10,014
Agricultural imports (crops and livestock)	17,641	18,981
Exports, all merchandise	39,853	42,137
Imports, all merchandise	78,895	86,333

Source: FAOSTAT (A4).

10.2 Exports

The three main farm products exported in 2024 are: Oranges ($893 million), wheat and meslin flour ($456 million) and potatoes ($410 million).

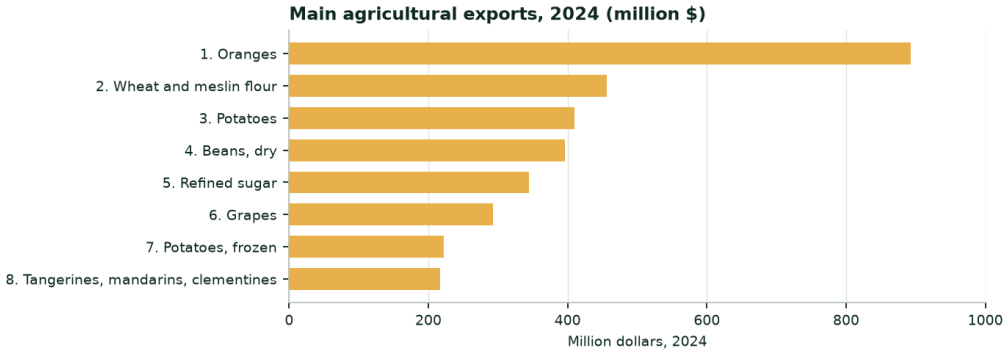


Figure 16. Main agricultural exports, 2024. Source: FAOSTAT (A4)

10.3 Imports

The main farm purchases are: Wheat ($4,443 million), maize (corn) ($2,272 million) and soya beans ($1,989 million).

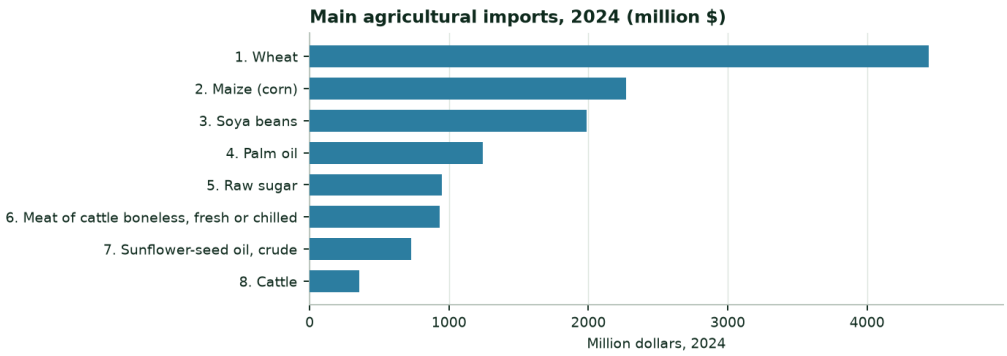


Figure 17. Main agricultural imports, 2024. Source: FAOSTAT (A4)



Figure 18. Sun-dried tomatoes near Luxor.



Harvested maize cobs.

10.4 Importing water-retention polymers into Egypt

What to know

• **Customs duty (heading 3906.90, acrylic polymers in primary forms):** The rate was not found in an official source (A12).

• **Import VAT:** 14%, calculated on the CIF value plus customs duty (A12).

• **Registration:** A fertiliser and soil conditioner control department exists at the Soil, Water and Environment Research Institute, and the Egyptian standards body publishes standards on soil conditioners (A13). The exact registration procedure was not found on an official site. No text specific to water-retaining agents was found.

• **Classification:** Code 3906.90 is an inference for our products; Egyptian Customs settle 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.



Crops and farmers on the banks of the Nile.

Alexandria (Alexandrie)

The north coast: The only region to receive rain, in winter; market gardening, orchards, olive and vines on the sandy soils of reclaimed desert land.

Indicator	Value
Annual rainfall, 1991-2020	95 mm
Reference evapotranspiration	1,545 mm
Annual water deficit	1,450 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,110 kWh/m²
Mean temperature	20.5 °C

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

Mansoura (Mansourah)

The eastern Delta: Rice, maize, cotton, vegetables and citrus, on small farms watered by a dense network of canals.

Indicator	Value
Annual rainfall, 1991-2020	43 mm
Reference evapotranspiration	1,743 mm
Annual water deficit	1,700 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,101 kWh/m²
Mean temperature	21.3 °C

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

Tanta (Tanta)

The heart of the Delta: Wheat, rice, maize, berseem clover, cotton and onion; the oldest and most intensive land in the country.

Indicator	Value
Annual rainfall, 1991-2020	33 mm
Reference evapotranspiration	1,786 mm

Indicator	Value
Annual water deficit	1,753 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,116 kWh/m²
Mean temperature	21.4 °C

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

Ismailia (Ismaïlia)

The Suez Canal zone: Citrus, mango and new-land crops, irrigated from the freshwater canal.

Indicator	Value
Annual rainfall, 1991-2020	24 mm
Reference evapotranspiration	1,828 mm
Annual water deficit	1,804 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,175 kWh/m²
Mean temperature	21.3 °C

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

Cairo (Le Caire)

The Delta apex and Giza: Vegetables, fruit and fodder next to the country's largest city, on land that urbanisation is eating away.

Indicator	Value
Annual rainfall, 1991-2020	18 mm
Reference evapotranspiration	1,978 mm
Annual water deficit	1,960 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,186 kWh/m²
Mean temperature	22.0 °C

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

Faiyum (Fayoum)

The Fayoum depression: An oasis fed by the Bahr Yussef canal; olive, citrus, vegetables and spring crops.

Indicator	Value
Annual rainfall, 1991-2020	10 mm
Reference evapotranspiration	2,061 mm
Annual water deficit	2,051 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,241 kWh/m²
Mean temperature	22.7 °C

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

Minya (Minya)

Middle Egypt: Sugar cane, wheat, maize, vegetables and onion in the narrow Nile valley, and new desert land along its edge.

Indicator	Value
Annual rainfall, 1991-2020	5 mm
Reference evapotranspiration	2,274 mm
Annual water deficit	2,269 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,254 kWh/m²
Mean temperature	23.1 °C

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

Asyut (Assiout)

Upper Egypt, north: Wheat, maize, pulses and sugar cane; basin irrigation has given way to year-round irrigation.

Indicator	Value
Annual rainfall, 1991-2020	5 mm
Reference evapotranspiration	2,382 mm
Annual water deficit	2,377 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,323 kWh/m²
Mean temperature	23.8 °C

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

Luxor (Louxor)

Upper Egypt, centre: Sugar cane, wheat, fenugreek and aromatic plants, under very strong summer heat.

Indicator	Value
Annual rainfall, 1991-2020	3 mm
Reference evapotranspiration	2,424 mm
Annual water deficit	2,421 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,406 kWh/m²
Mean temperature	25.3 °C

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

Aswan (Assouan)

The far south: Sugar cane, dates and new-land crops near Lake Nasser, under a hot desert climate.

Indicator	Value
Annual rainfall, 1991-2020	2 mm
Reference evapotranspiration	2,940 mm
Annual water deficit	2,938 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,440 kWh/m²
Mean temperature	26.8 °C

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

Kharga (Kharga)

The New Valley: Western Desert oases irrigated from the deep aquifer; dates, olive, wheat and new farms.

Indicator	Value
Annual rainfall, 1991-2020	2 mm
Reference evapotranspiration	2,586 mm
Annual water deficit	2,584 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,414 kWh/m²
Mean temperature	23.7 °C

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

Siwa (Siwa)

The Siwa oasis: Dates and olives in a salty depression, where the water table is close to the surface but salty.

Indicator	Value
Annual rainfall, 1991-2020	11 mm
Reference evapotranspiration	2,063 mm
Annual water deficit	2,052 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,260 kWh/m²
Mean temperature	21.7 °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), Egypt	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	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, "Irrigation in the Near East Region in figures" (Water Report No. 9, 1997), Egypt profile: Irrigation potential and equipped area (1993 data); 1959 Nile waters agreement	A
A12	PwC, Worldwide Tax Summaries, Egypt, "Other taxes": Import VAT, calculated on the CIF value plus customs duty. The customs duty rate for heading 3906.90 was not found in an official source	C
A13	Egypt Trade Portal, administration contacts: Fertilisers and Agricultural Soil Conditioners Control Department, Soil, Water and Environment Research Institute (Giza); Egyptian Organization for Standards and Quality (EOS), fertiliser and soil conditioner standards	C
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

Ref.	Source	Level
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 (77,500 Mm³, 2022) × agricultural share (79.16%) = 61,350.0 Mm³.

2. Irrigation. The equipped area (4,013,710 ha) and agricultural water are shared between irrigated groups (wheat, barley, sorghum, maize, rice, sugar cane and sugar beet, potato, vegetables and melons, citrus, date palm, other fruit, cotton, groundnut, sesame, sunflower, soybean and pulses) in proportion to their harvested areas (5,876,526 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 is smaller than the sum of harvested areas of the irrigable crops, because several crops follow each other on the same land: Agricultural water is therefore shared pro rata to harvested areas, and the irrigated area attributed to each group is capped at its harvested area. Wheat, rice, maize and cane are treated as irrigated, Egyptian farming being almost entirely irrigated.

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 (15,285 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 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 broad area is shown as a point at its reference town: The twenty-seven governorates are too small for a readable map.

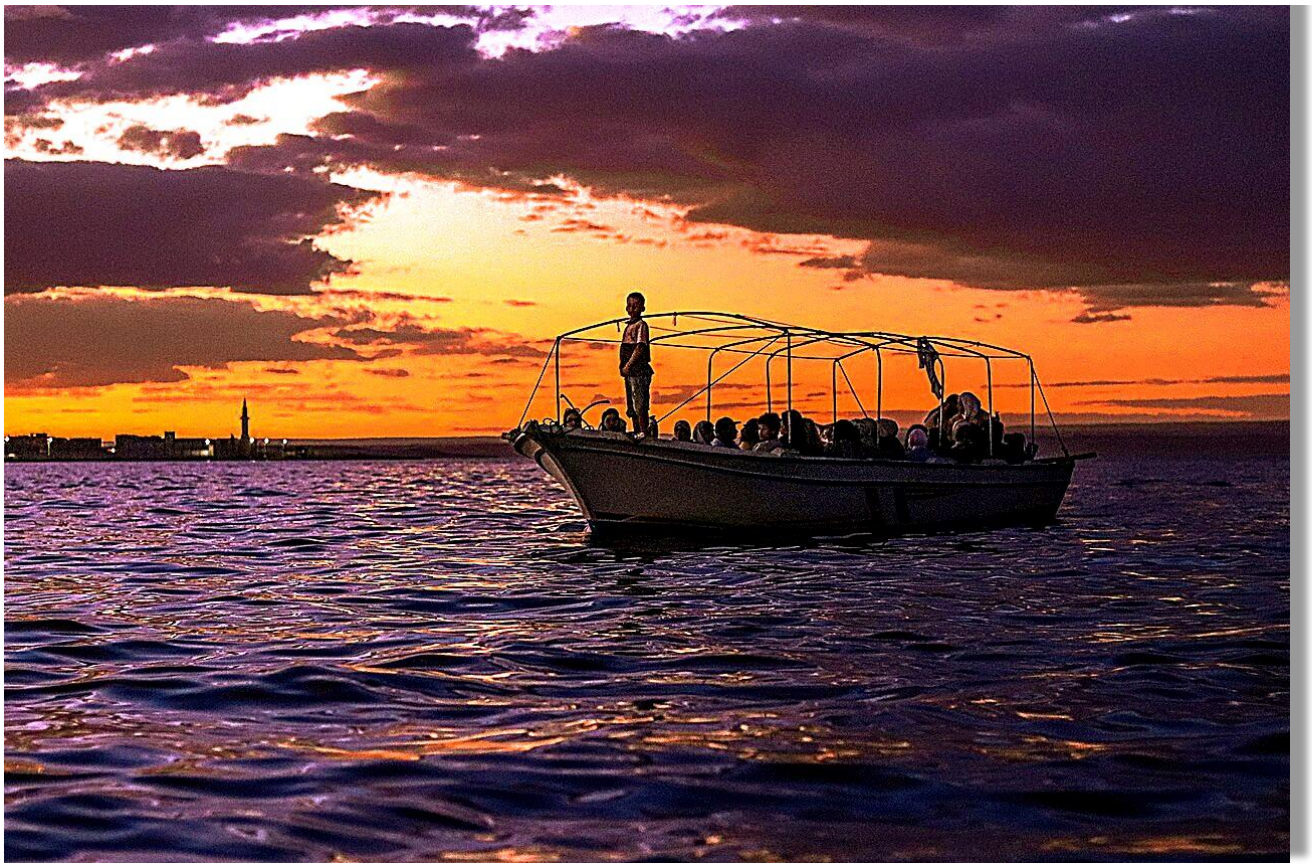
9. Trade. Totals are those of the FAOSTAT crops and livestock line; products are listed one by one, without aggregates. Rice amounts add husked rice, broken rice and milled rice.

Annex C. Photo credits

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Sunset over a lake in the Fayoum.

Green Solutions

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