

COUNTRY DOSSIER

Jordan

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

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Wheat fields near Mukhraba, in Irbid governorate.

Foreword

This dossier describes Jordan 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, Jordanian public bodies (Department of Statistics, Ministry of Agriculture, Ministry of Water and Irrigation)).
- **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 Jordan.

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Summary

The points below summarise the dossier. The figures come from public sources: The World Bank, FAO (FAOSTAT, AQUASTAT), Jordanian public bodies (Department of Statistics, Ministry of Agriculture, Ministry of Water and Irrigation), PVGIS and NASA POWER. The production gains and water savings are scenarios, described in Annex B.

11.52 M
Inhabitants in 2025 (World Bank)

57,840 ha
Of olives harvested in 2024, the main crop

91,239 ha
Equipped for irrigation (2024)

96.5 Mm³
Of irrigation water saved a year, central scenario

1,018 M$
Of agricultural exports in 2024 (FAOSTAT)

Key points

• **Irrigation, a pillar of production.** 0.09 million hectares equipped for irrigation in 2024, or 32% of the 0.28 million hectares of cropland.

• **Olives: The main crop.** 57,840 ha harvested in 2024, for 0.22 million tonnes, or 3.82 t/ha.

• **Water is scarce.** National water stress reaches 105.2%; at Aqaba, the air demands 1,971 mm more than it rains.

• **In irrigation, the water saved enlarges the schemes.** 96.5 Mm³ a year in the central scenario, enough to irrigate about 17,947 more ha, or 19.7% of the equipped area.

• **An organic chain.** 580 ha of certified organic cropland in 2024: ECOFERT® is EU Bio certified.

• **Fertilisers made locally.** 16,039 t of nitrogen used in 2024; the country produces 151,100 t and imports 27,264 t.

• **Farm trade.** $1,018 million of exports and $4,533 million of imports in 2024. First sale: Sheep ($135 million). Rice weighs $232 million of purchases.

Key figures

Key indicators for Jordan

Indicator	Value	Year	Source (level)
Population	11.52 M	2025	World Bank (A1)
GDP per capita	5,348 $	2025	World Bank (A1)
Agriculture share of GDP	5.6%	2025	World Bank (A1)
Agricultural employment	3.1%	2025	World Bank (A1)
Cropland	285,000 ha	2024	FAOSTAT (A6)
Area equipped for irrigation	91,239 ha	2024	FAOSTAT (A6)
Harvested area: Olives	57,840 ha	2024	FAOSTAT (A2)
Certified organic cropland	580 ha	2024	FAOSTAT (A6)
Agricultural exports	1,018 M$	2024	FAOSTAT (A4)
Agricultural imports	4,533 M$	2024	FAOSTAT (A4)
Mineral nitrogen, agricultural use	16,039 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 Jordan. 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 near Al-Mashare'a, above the Jordan Valley.

2. Jordan in figures

Jordan had 11.52 million inhabitants in 2025, 7% of them in rural areas. Agriculture accounts for 5.6% of gross domestic product and employs 3% of the labour force. The country covers 88.8 thousand km², of which 12% is agricultural land. Undernourishment affects 12.2% of the population.

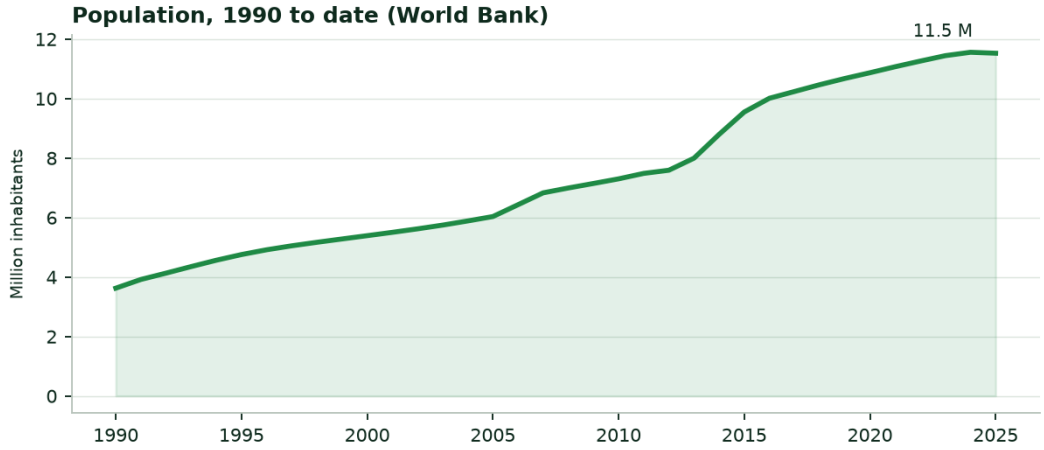


Figure 1. Population of Jordan, 1990 to date. Source: World Bank (A1)

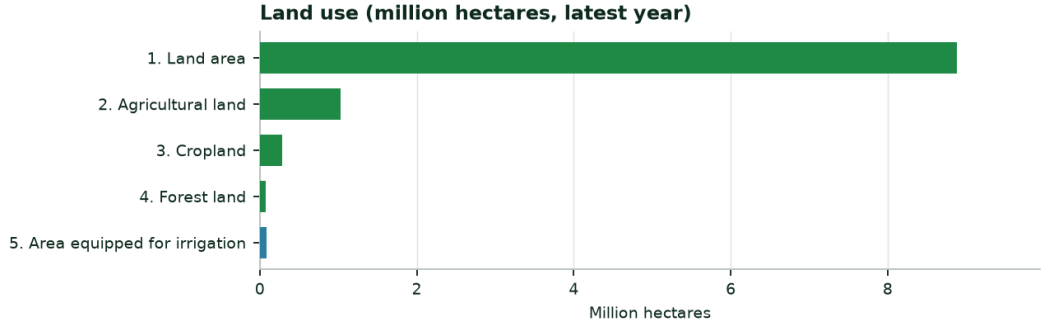


Figure 2. Land use, latest year published. Source: FAOSTAT (A6)

Agricultural and water indicators, latest year published

Indicator	Value	Year	Source
Cropland certified organic	580 ha	2024	FAOSTAT (A6)
Average cereal yield	1,611 kg/ha	2024	World Bank (A1)
Fertiliser use per hectare of arable land	111.9 kg/ha	2024	World Bank (A1)
Water withdrawals, agricultural share	51.6%	2022	World Bank (A1)
Internal freshwater resources	0.7 km³	2022	World Bank (A1)
Internal resources per inhabitant	61 m³	2022	World Bank (A1)



The Aidoun heights and their fields (Irbid governorate).

3. Sunshine, rainfall and climate change

3.1 Sunshine

Global solar radiation reaches 1,999 to 2,290 kWh/m² a year depending on the region. Energy is not the limit: Water available at the right time makes the harvest.

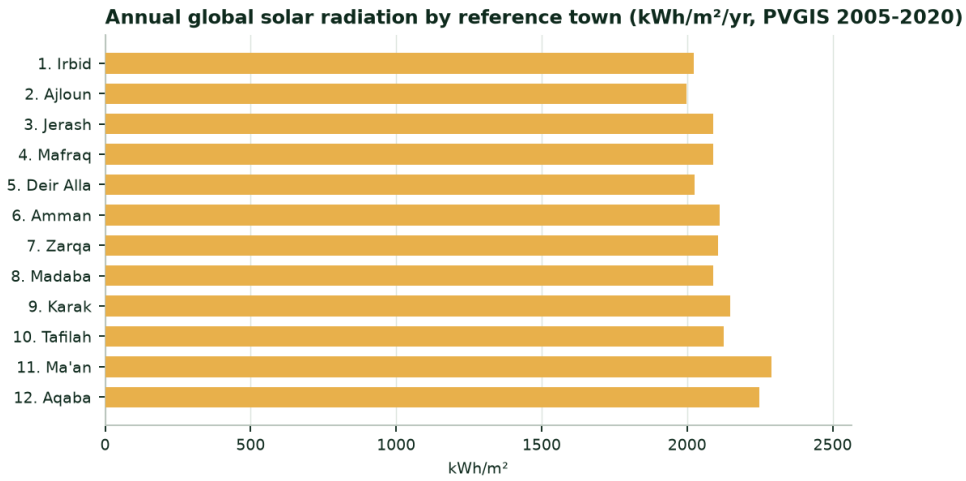


Figure 3. Annual global solar radiation in each reference town. Source: PVGIS (A8)

3.2 Rainfall and evapotranspiration

It rains 373 mm a year at Irbid, but only 47 mm at Aqaba, where reference evapotranspiration reaches 2,018 mm. Rain falls from October to April, mostly from December to February, and the summer is completely dry. The north-western heights receive the most water; the east and south are desert.

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

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irbid	91	77	46	17	6	1	0	1	1	13	43	78
Ajloun	91	77	46	17	6	1	0	1	1	13	43	78
Jerash	91	77	46	17	6	1	0	1	1	13	43	78
Mafraq	46	41	26	10	4	1	0	1	1	7	20	39
Deir Alla	65	58	36	12	5	1	0	1	1	10	31	54
Amman	44	42	26	9	4	1	1	1	1	6	19	37
Zarqa	44	42	26	9	4	1	1	1	1	6	19	37
Madaba	46	41	26	8	4	0	0	0	1	7	20	35
Karak	58	45	24	10	4	0	0	0	1	8	19	33
Tafilah	58	45	24	10	4	0	0	0	1	8	19	33
Ma'an	16	15	8	4	2	0	0	1	1	6	8	9
Aqaba	11	9	5	3	1	0	0	0	2	4	6	6

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

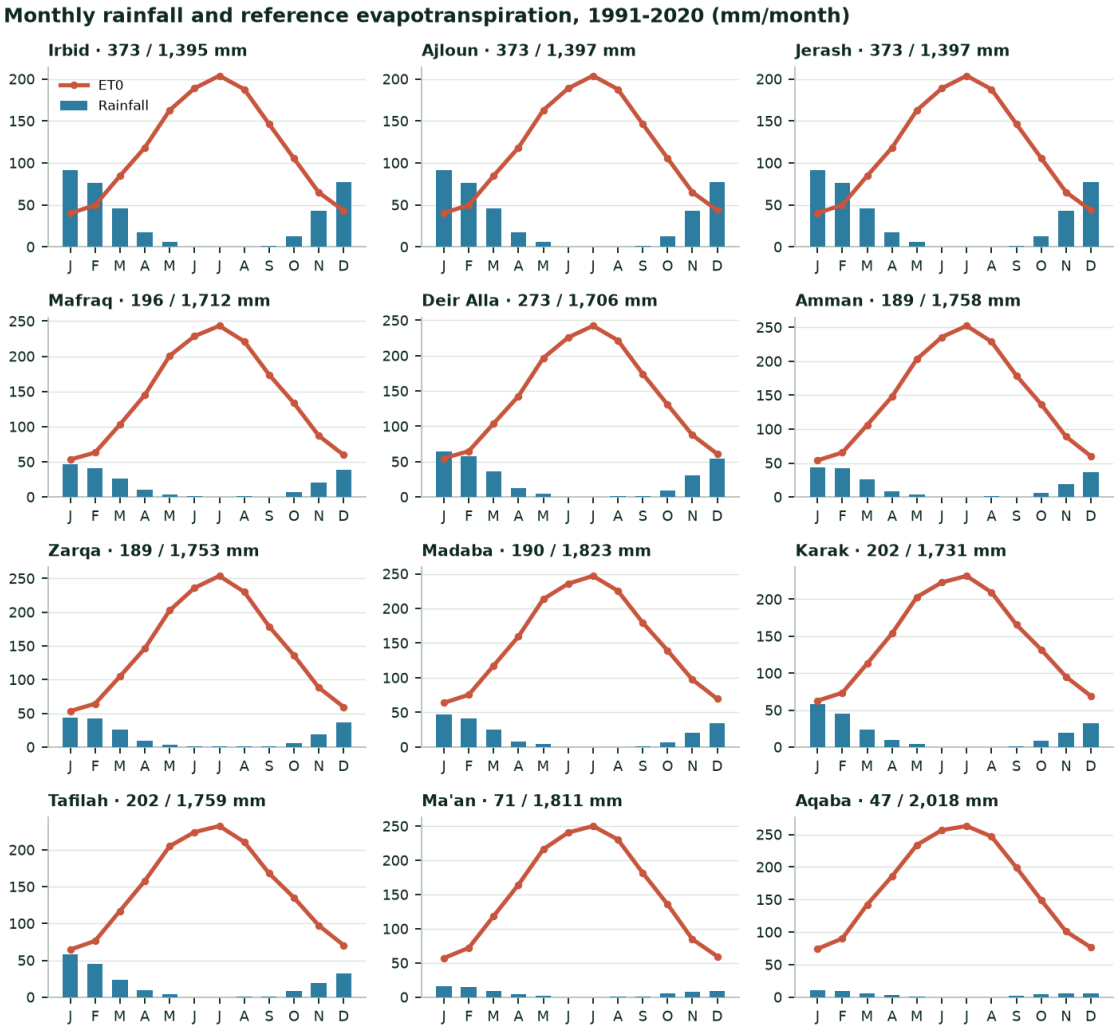


Figure 4. Monthly rainfall and reference evapotranspiration by city, 1991-2020. Source: NASA POWER (A9)

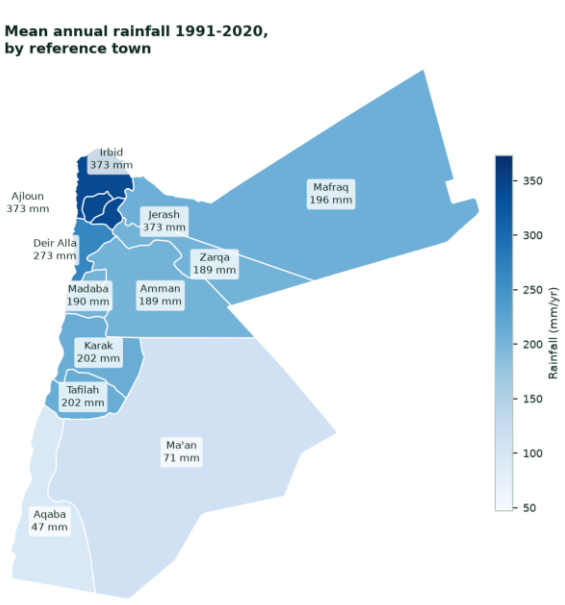
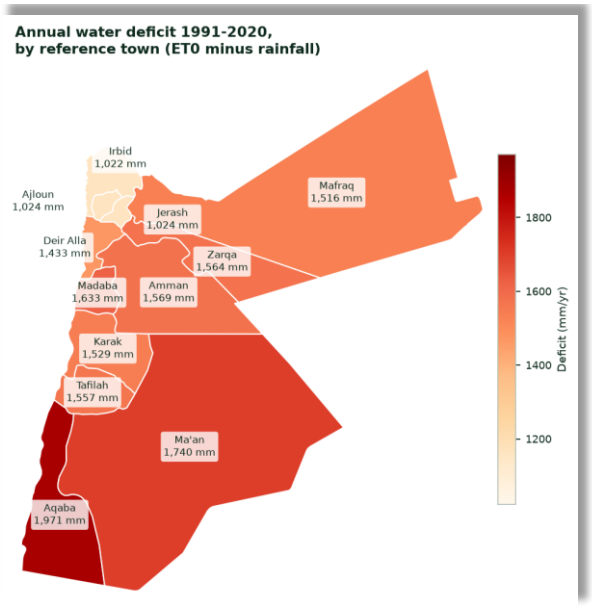


Figure 5. Mean annual rainfall 1991-2020, by region. Source: NASA POWER (A9), Natural Earth (A10).



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

3.3 Climate change

Mean annual temperature is rising. At Amman it went from 16.6 °C in 1981 to 18.8 °C in 2024, a trend of 0.51 °C per decade. At Deir Alla the trend is 0.49 °C per decade, from 20.1 °C to 22.3 °C. Warmer air dries the soil faster between two rains.

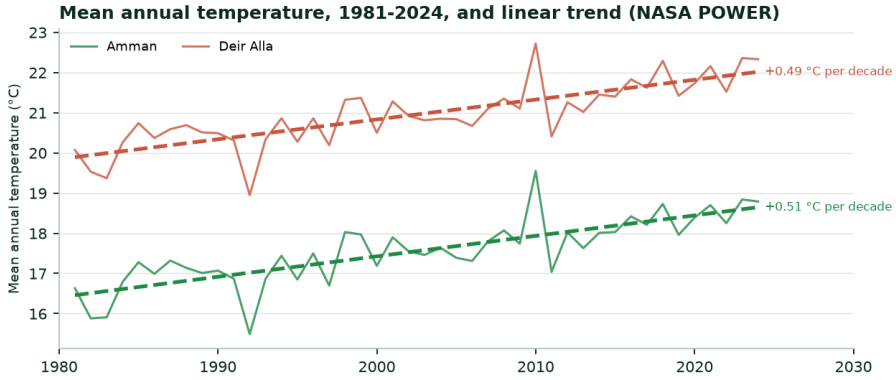


Figure 6. Mean annual temperature, 1981-2024, and linear trend. Source: NASA POWER (A9)



The Wadi Rum desert, in the south.

4. Water: Resources, irrigated areas, withdrawals

4.1 Resources and withdrawals

Total freshwater withdrawals are 950 million m³ a year (2022). Agriculture withdraws 51.6% of it, that is 491 Mm³. Internal resources are 0.7 km³ a year and water stress is 105.2%: The resource is already heavily used: Every cubic metre kept in the soil counts.

Freshwater: Withdrawals and resources

Indicator	Value	Year	Source
Total withdrawals	950 Mm³	2022	World Bank (A1)
Agricultural share	51.6%	2022	World Bank (A1)
Agricultural withdrawals	490.6 Mm³	2022	Calculated from A1
Area equipped for irrigation	91,239 ha	2024	FAOSTAT (A6)
Agricultural withdrawals per equipped hectare	5,377 m³/ha	—	Calculation (Annex B)
Water stress	105.2%	2022	World Bank (A1)

4.2 Irrigated areas

FAOSTAT counts 91,239 hectares equipped for irrigation in 2024. In 2024, the area equipped for irrigation reaches 91,240 ha and the area actually irrigated 92,800 ha; 4,300 ha of crops are under protective cover (A6). Irrigation is concentrated in the Jordan Valley, fed by the King Abdullah Canal, and on borehole farms of the eastern and southern plateaus.



The King Abdullah Canal, which irrigates the Jordan Valley.

4.3 What the water saving represents

In the central scenario, the saving is 96.5 million m³ a year, or 19.7% of agricultural withdrawals. At 5,377 m³ per equipped hectare, this water would irrigate about 17,947 more hectares, or 19.7% of today's equipped area.

5. Fertilisers: Quantities, purchases, spending

5.1 Quantities used

In 2024, agricultural use reaches 16,039 tonnes of nitrogen, 2,945 tonnes of phosphate (P2O5) and 3,515 tonnes of potash (K2O). The country produces 151,100 tonnes of nitrogen and 383,400 tonnes of phosphate (P2O5); it imported 27,264 tonnes of nitrogen in the same year. Per hectare of arable land, use is 111.9 kg per hectare.

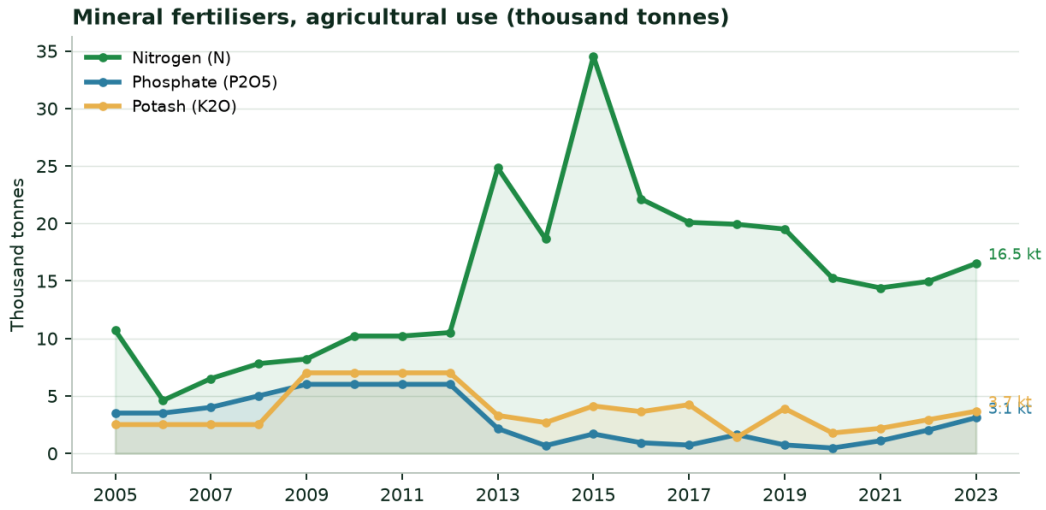


Figure 7. Mineral fertilisers, agricultural use, 2005-2023. Source: FAOSTAT (A5)

5.2 Regulatory framework

Agriculture Law No. 13 of 2015 requires a licence to produce and trade fertilisers, from the Ministry of Agriculture (A13). A water-retaining polymer would come under it according to its classification, to be confirmed with the ministry.



Farmland and olive trees on the slopes of the Mujib valley.

5.3 Indicative spending

In 2024, the indicative minimum spending on mineral fertilisers reaches $17 million, at international fertiliser prices (calculation in Annex B, lower bound).

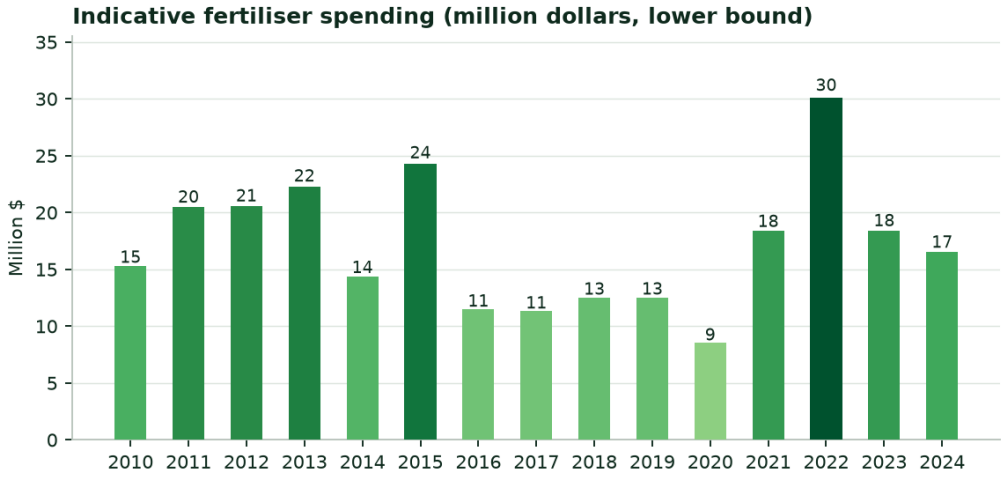


Figure 8. Indicative fertiliser spending, lower bound. Source: Author's calculation from A5 and A7

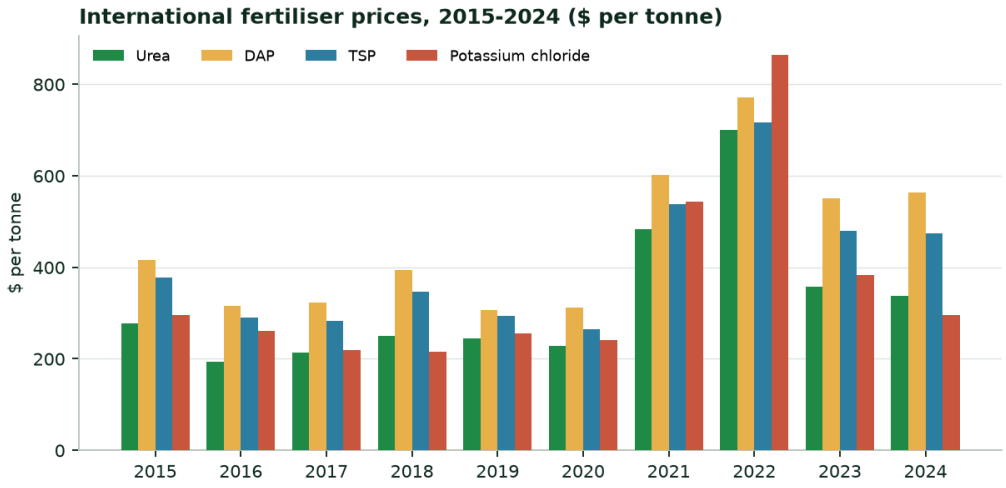


Figure 9. International prices of urea, DAP, TSP and potassium chloride. Source: World Bank, Pink Sheet (A7)

6. The regions at a glance

The table compares the twelve governorates, 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)
Irbid (Irbid)	373	1,395	1,022	2,022	20.1
Ajloun (Ajloun)	373	1,397	1,024	1,999	20.1
Jerash (Jerash)	373	1,397	1,024	2,090	20.1
Mafraq (Mafraq)	196	1,712	1,516	2,091	17.5
Balqa (Deir Alla)	273	1,706	1,433	2,027	21.0
Amman (Amman)	189	1,758	1,569	2,112	17.6
Zarqa (Zarqa)	189	1,753	1,564	2,107	17.6
Madaba (Madaba)	190	1,823	1,633	2,091	21.8
Karak (Karak)	202	1,731	1,529	2,149	19.2
Tafilah (Tafilah)	202	1,759	1,557	2,126	19.2

Region (city)	Rainfall (mm/yr)	ET0 (mm/yr)	Deficit (mm/yr)	Radiation (kWh/m²/yr)	Temperature (°C)
Ma'an (Ma'an)	71	1,811	1,740	2,290	16.4
Aqaba (Aqaba)	47	2,018	1,971	2,249	20.0

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

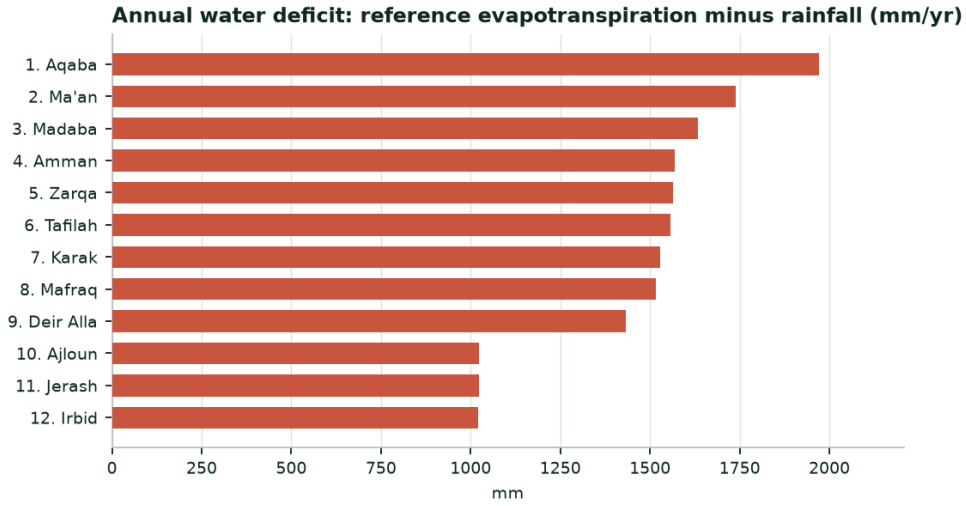


Figure 10. Annual water deficit: Reference evapotranspiration minus rainfall. Source: NASA POWER (A9)



Landscape of Sakib, in Jerash governorate.

7. The twenty main crops: Three rankings

7.1 By harvested area

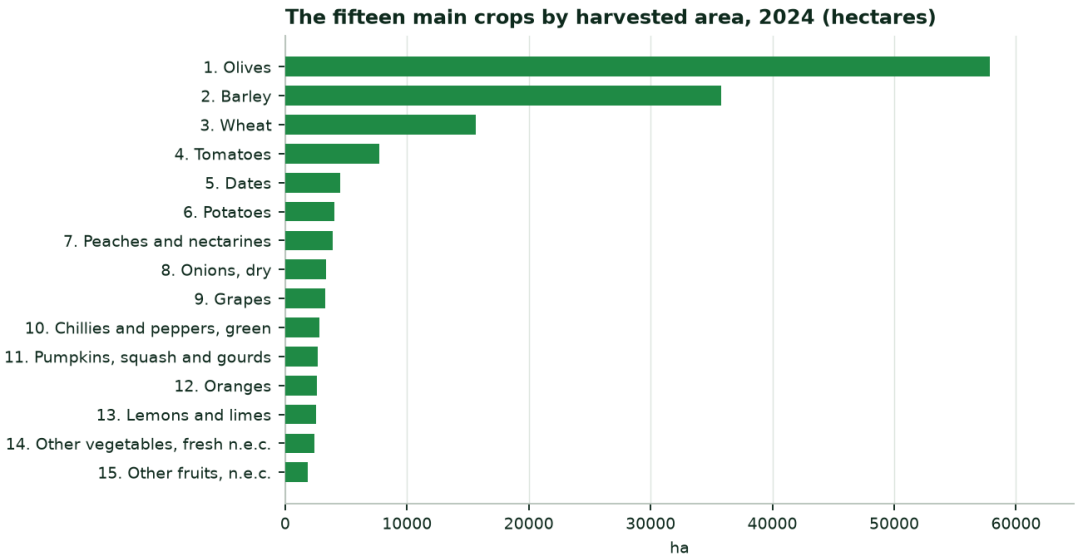


Figure 11. The fifteen main crops by harvested area, 2024 (hectares). Source: FAOSTAT (A2)

The ten main crops by area, 2024

Crop	Harvested area (ha)	Production (t)	Yield (t/ha)
Olives	57,840	220,746	3.82
Barley	35,805	43,180	1.21
Wheat	15,617	34,429	2.20
Tomatoes	7,717	563,548	73.03
Dates	4,495	32,618	7.26
Potatoes	4,043	161,367	39.91
Peaches and nectarines	3,882	105,423	27.16
Onions, dry	3,375	133,239	39.48
Grapes	3,258	27,950	8.58
Chillies and peppers, green	2,823	122,252	43.31

Source: FAOSTAT (A2).

7.2 By production

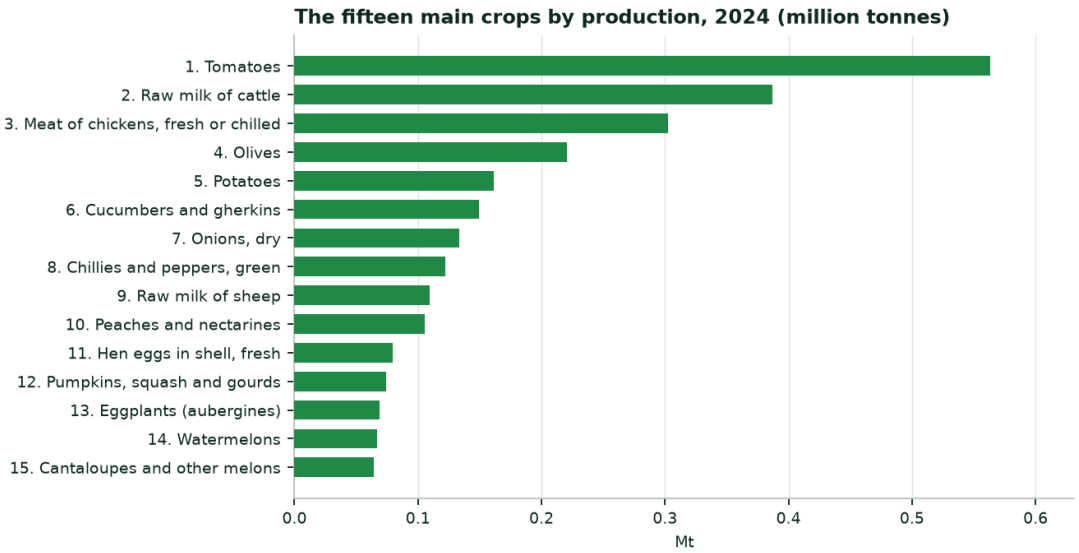


Figure 12. The fifteen main crops by production, 2024 (million tonnes). Source: FAOSTAT (A2)

7.3 By production value

By production value, the three main crops are: Tomatoes, olives and chillies and peppers, green (FAOSTAT, 2023, constant international dollars).

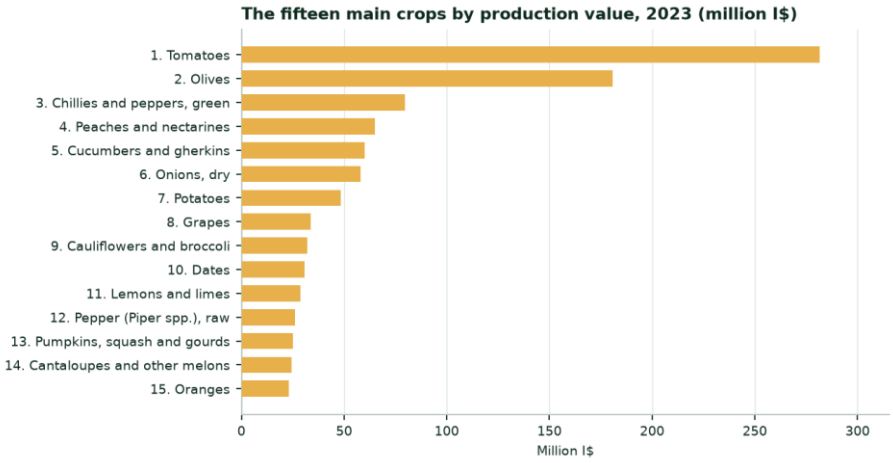


Figure 13. The fifteen main crops by production value, 2023 (million I$). Source: FAOSTAT (A3)



Vegetable plots in Aqaba, on the Red Sea.

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, date palm, citrus, other fruit 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), 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%	Not used; cited for reference
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 Jordan: The figures below apply the trials cited to the country's average yields.

8.3 Irrigation: Vegetables and melons, Potato, Date palm 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, cucumber, pepper, others)	33,497	36.7%	Watermelon, Mexico (2023)	54.5
Potato	4,043	4.4%	Potato, South Africa (2025)	5.7
Date palm	4,495	4.9%	Date palm, UAE (ICBA, 2021)	9.9
Citrus (orange, lemon, mandarin, grapefruit)	7,054	7.7%	Generic assumption, no trial	3.8
Other fruit (peach, grape, apple, banana, apricot)	14,434	15.8%	Generic assumption, no trial	7.8
Other irrigated land (irrigated olives, fodder, cereals)	27,716	30.4%	Generic assumption, no trial	14.9

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	48.2	8,974	129,129
Central	96.5	17,947	258,259

Scenario	Water (Mm³/yr)	Extra hectares	Production (t/yr)
High	193.0	35,895	516,517

Source: Author's calculation (Annex B).

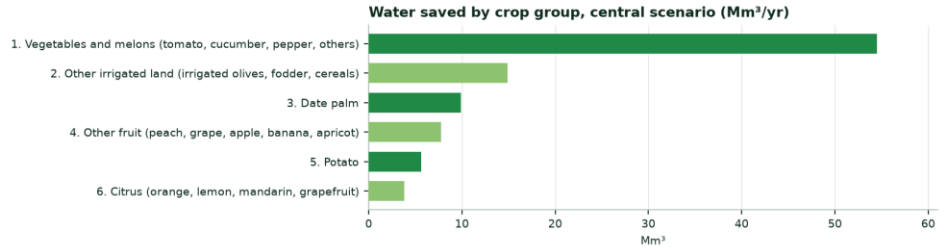


Figure 14. Water saved by crop group, central scenario. Source: Author's calculation

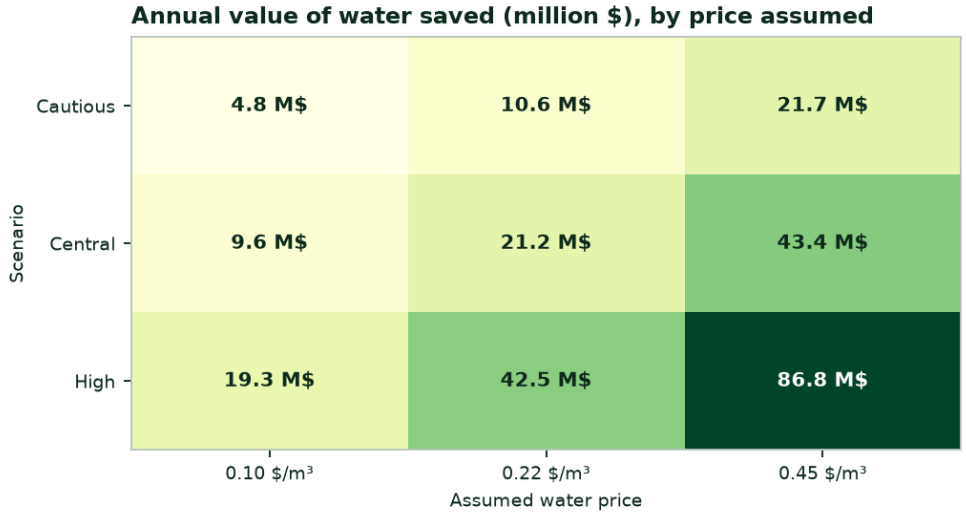


Figure 15. Annual value of the water saved, by price assumed per cubic metre. Source: Author's calculation; prices assumed, no national tariff

8.4 Reading the results

Key points

• The "vegetables and melons" group gives 56% 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 Jordan
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 Jordan

Source: Annex A.



Green terraces and a greenhouse near Tafilah.

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)	1,638	1,018
Agricultural imports (crops and livestock)	5,053	4,533
Exports, all merchandise	12,763	13,292
Imports, all merchandise	25,470	26,792

Source: FAOSTAT (A4).

10.2 Exports

The three main farm products exported in 2024 are: Sheep ($135 million), peaches and nectarines ($63 million) and other manufactured tobacco ($47 million).

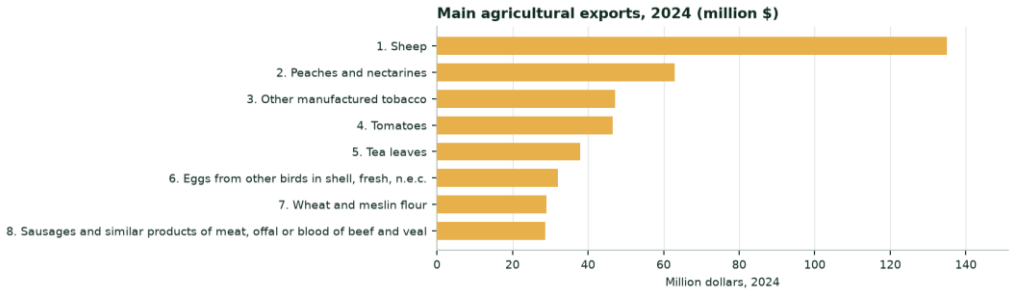


Figure 16. Main agricultural exports, 2024. Source: FAOSTAT (A4)

10.3 Imports

The main farm purchases are: Meat of chickens, fresh or chilled ($183 million), unmanufactured tobacco ($169 million) and sheep ($162 million). Rice weighs $232 million (husked, broken and milled rice): Every tonne grown locally reduces this bill.

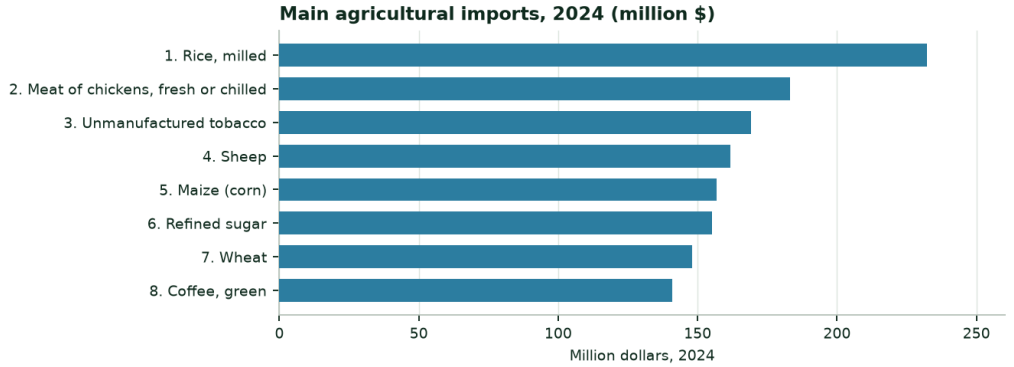


Figure 17. Main agricultural imports, 2024. Source: FAOSTAT (A4)



Figure 18. Fruit and vegetable stalls in an Amman souk.



The Amman fruit and vegetable market.

10.4 Importing water-retention polymers into Jordan

What to know

• **Customs duty (subheading 3906.90):** 0% at the most-favoured-nation rate, on the only national line of the subheading (A11).

• **General sales tax:** 16%, a tax that works like a VAT (A12).

• **Licence:** Law No. 13 of 2015 requires a licence to produce and trade fertilisers and plant growth regulators, from the Ministry of Agriculture (A13). No text specific to water-retaining agents was found: Their classification (fertiliser, soil conditioner or other) is to be confirmed with the ministry.

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



Olive groves and orchards in the Mujib valley, western Jordan.

Irbid (Irbid)

Northern plateau and Jordan Valley: Rainfed wheat and barley, olive groves on the heights, and below, the irrigated vegetables and citrus of the Northern Ghor.

Indicator	Value
Annual rainfall, 1991-2020	373 mm
Reference evapotranspiration	1,395 mm
Annual water deficit	1,022 mm
Months with less than 50 mm of rain	9
Global solar radiation	2,022 kWh/m²
Mean temperature	20.1 °C

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

Ajloun (Ajloun)

Wooded hills, the wettest in the country: Olive groves, fruit trees and small family farms on terraces.

Indicator	Value
Annual rainfall, 1991-2020	373 mm
Reference evapotranspiration	1,397 mm
Annual water deficit	1,024 mm
Months with less than 50 mm of rain	9
Global solar radiation	1,999 kWh/m²
Mean temperature	20.1 °C

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

Jerash (Jerash)

Northern highlands: Olive groves, orchards and poultry, with enough winter rain for rainfed crops.

Indicator	Value
Annual rainfall, 1991-2020	373 mm
Reference evapotranspiration	1,397 mm
Annual water deficit	1,024 mm
Months with less than 50 mm of rain	9
Global solar radiation	2,090 kWh/m²
Mean temperature	20.1 °C

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

Mafraq (Mafraq)

Eastern steppe and desert: Farms irrigated from boreholes (vegetables, fruit, olives) and sheep, on a heavily used aquifer.

Indicator	Value
Annual rainfall, 1991-2020	196 mm
Reference evapotranspiration	1,712 mm
Annual water deficit	1,516 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,091 kWh/m²
Mean temperature	17.5 °C

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

Balqa (Deir Alla)

Central Jordan Valley, below sea level: Winter vegetables, citrus and bananas irrigated from the King Abdullah Canal.

Indicator	Value
Annual rainfall, 1991-2020	273 mm
Reference evapotranspiration	1,706 mm
Annual water deficit	1,433 mm
Months with less than 50 mm of rain	9
Global solar radiation	2,027 kWh/m²
Mean temperature	21.0 °C

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

Amman (Amman)

Capital region: Olive groves, peri-urban vegetables and poultry in the west, steppe and livestock in the east.

Indicator	Value
Annual rainfall, 1991-2020	189 mm
Reference evapotranspiration	1,758 mm
Annual water deficit	1,569 mm
Months with less than 50 mm of rain	12

Indicator	Value
Global solar radiation	2,112 kWh/m²
Mean temperature	17.6 °C

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

Zarqa (Zarqa)

Zarqa basin: Fodder and crops irrigated partly with treated wastewater, livestock and industry.

Indicator	Value
Annual rainfall, 1991-2020	189 mm
Reference evapotranspiration	1,753 mm
Annual water deficit	1,564 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,107 kWh/m²
Mean temperature	17.6 °C

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

Madaba (Madaba)

Central plateau: Rainfed wheat and barley, olive groves and sheep, with yields that follow the year's rain.

Indicator	Value
Annual rainfall, 1991-2020	190 mm
Reference evapotranspiration	1,823 mm
Annual water deficit	1,633 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,091 kWh/m²
Mean temperature	21.8 °C

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

Karak (Karak)

Plateau and Southern Ghor: Cereals and olives on the heights, irrigated vegetables and bananas by the Dead Sea.

Indicator	Value
Annual rainfall, 1991-2020	202 mm
Reference evapotranspiration	1,731 mm
Annual water deficit	1,529 mm
Months with less than 50 mm of rain	11
Global solar radiation	2,149 kWh/m²
Mean temperature	19.2 °C

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

Tafilah (Tafilah)

Southern highlands: Rainfed cereals, olive groves and small irrigated plots in the valleys.

Indicator	Value
Annual rainfall, 1991-2020	202 mm
Reference evapotranspiration	1,759 mm

Indicator	Value
Annual water deficit	1,557 mm
Months with less than 50 mm of rain	11
Global solar radiation	2,126 kWh/m²
Mean temperature	19.2 °C

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

Ma'an (Ma'an)

Southern desert: Large borehole-irrigated farms, olives and livestock, with almost no rain.

Indicator	Value
Annual rainfall, 1991-2020	71 mm
Reference evapotranspiration	1,811 mm
Annual water deficit	1,740 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,290 kWh/m²
Mean temperature	16.4 °C

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

Aqaba (Aqaba)

Desert and Wadi Araba: Irrigated date palms and vegetables, under the country's highest heat.

Indicator	Value
Annual rainfall, 1991-2020	47 mm
Reference evapotranspiration	2,018 mm
Annual water deficit	1,971 mm
Months with less than 50 mm of rain	12
Global solar radiation	2,249 kWh/m²
Mean temperature	20.0 °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), Jordan	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), Jordan, applied MFN duties, subheading 3906.90, 2023	A
A12	PwC, Worldwide Tax Summaries, Jordan, other taxes: General sales tax	C

Ref.	Source	Level
A13	Agriculture Law No. 13 of 2015 (Jordan), as summarised in FAO's FAOLEX database: Licences to produce and trade seeds, fertilisers and plant growth regulators	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 (950 Mm³, 2022) × agricultural share (51.65%) = 490.6 Mm³.

2. Irrigation. The equipped area (91,239 ha) and agricultural water are shared between irrigated groups (vegetables and melons, potato, date palm, citrus, other fruit and other irrigated land) in proportion to their harvested areas (91,239 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 (irrigated olives, fodder, irrigated cereals), with the generic assumption. Olives and cereals 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 (5,377 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 governorate 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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Green hills seen from Umm Qais, in the north of the country.

Green Solutions

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