

COUNTRY DOSSIER

Sultanate of Oman

Water, climate, fertilisers and crops: Figures by governorate and by crop, potential benefits of our products, external trade

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Foreword

This dossier describes the Sultanate of Oman from the angle of irrigation water, climate, fertilisers and crops. It is intended for the authorities responsible for agriculture and water resources, and for the economic players of the sector. It answers three questions: Where is water used, for which crops, and with what reserves? It then examines what our products can change, and what that may be worth.

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 (FAO, World Bank, National Centre for Statistics and Information, European Commission).
- **B**: Research institute, university, public body outside statistics, or recognised climate model.
- **C**: Manufacturer statement, non-independent demonstration, press, or estimate.
- « bn » means billion; « M » means million; « Mm³ » means million cubic metres.
- Oman reports farm areas in feddans (about 0.42 ha). English-language press often calls them « acres ».
- A « scenario » is a calculation based on the trials cited. It is not a measurement made in Oman.

What this dossier does not do. It does not turn a trial carried out elsewhere into an Omani result. Water savings and yield gains by crop are scenarios, built from the trials cited.

What remains to be completed. Cultivated area and irrigation volumes by governorate, and the water use of date palms and fodder under Omani conditions. Section 11 gives the details.

Contents

Summary
1. Green Solutions and our products
2. Oman in figures
3. Sunshine, rainfall and climate change
4. Irrigation water: Volumes, prices, investment, scarcity
5. Fertilisers: Quantities, prices, spending
6. By governorate
7. The twenty main crops: Three rankings
8. Extrapolation by crop and water savings
9. Potential benefits of our products
10. External trade: Exports and imports
11. Limits and points to complete
Annex A. Sources and confidence levels
Annex B. Calculation method

Summary

The seven points below summarise the dossier. The key figures come from public sources (FAO, World Bank, National Centre for Statistics and Information, PVGIS). Water savings are scenarios, described in Annex B.

1,320 Mm³
Of water withdrawn each year for agriculture, 81% of all withdrawals (World Bank, 2022).

117%
Of internal renewable water resources withdrawn each year (2022): Oman uses more water than it renews.

293 Mm³
Of water saved per year in the central scenario, 22% of agricultural water.

377,066 t
Of dates produced in 2022 (NCSI), from about 9.1 million date palms (ministry, 2023).

4.12 bn$
Of agricultural imports in 2024, against 969 M$ of exports (FAOSTAT).

12,821 t
Of nitrogen used by Omani agriculture in 2024, while Oman produced 1.64 Mt of nitrogen (FAOSTAT).

Seven key points

1. **Agriculture is the main water user.** It accounts for 81% of freshwater withdrawals according to the World Bank (2022), and 83 to 92 % of conventional water resources according to national sources.

2. **Oman withdraws more water than it renews.** Withdrawals reach 117% of internal renewable resources. The ministry's 2013 water balance showed a deficit of about 300 Mm³ per year, covered by over-pumping of aquifers; seawater is advancing into the Al Batinah aquifers.

3. **Very little rain, a great deal of sun.** From 22 mm per year at Haima to 158 mm at Khasab (1991–2020, ERA5-Land model), while the atmosphere demands about 2,026 mm per year at Nizwa. Every crop depends on irrigation.

4. **Fodder and date palms dominate.** In 2022, fodder crops covered 42.5% of the cultivated area, fruit 29.4% (mostly date palms) and vegetables 25.0% (NCSI).

5. **The potential water saving is large.** In the central scenario, 293 Mm³ per year, 22% of agricultural water and close to the 2013 national deficit. The range runs from 147 to 586 Mm³.

6. **Date palms carry the result.** They give 125 Mm³ of the central saving, using a published trial on date palms in sandy, saline soil in the United Arab Emirates (ICBA), the conditions closest to Oman's.

7. **Food security depends on imports.** In 2024, Oman imported 898 thousand tonnes of wheat and 325 thousand tonnes of rice. Domestic wheat production was 7.9 thousand tonnes in 2023.

Next steps

- Obtain the cultivated area and irrigation volumes by governorate from the ministry and the NCSI.
- Measure the water use of date palms and fodder under Omani conditions, by governorate.
- Choose two governorates, for example Ad Dakhiliyah (date palms) and Al Batinah (vegetables and fodder), for comparative trials before any extension.

Key figures

Key indicators for Oman

Indicator	Value	Year	Source (level)
Agricultural water withdrawals	1,320 million m³	2022	World Bank (A1, A)

Indicator	Value	Year	Source (level)
Withdrawals / internal renewable resources	116.7%	2022	World Bank (A1, A)
Area actually irrigated	107,100 ha	2023	FAOSTAT (A4, A)
Solar radiation (main towns)	2,104 to 2,307 kWh/m²/year	2005–2020	PVGIS (A11, A)
Rainfall (main towns)	22 to 158 mm/year	1991–2020	ERA5-Land (A12, B)
Date production	377,066 t	2022	NCSI (A8, A)
Potential water saving (central)	293 million m³/year	Scenario	Calculation (Annex B)

Source: See the « Source » column; levels explained in the foreword.

1. Green Solutions and our products

Green Solutions develops products for water, fertilisation and crop protection. Four families concern this dossier. The performances 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 retainer)	Holds rain or irrigation water as a gel, close to the roots	Trials on maize, potato, watermelon, date palm, soybean (sections 8 and 9)	B to C
ECOSORB® (water retainer based on maize starch)	Same use; effect lasts 2 to 3 years according to the website	Soybean trial (China); laboratory acrylamide analysis	B to C
ECOFERT® (fertiliser)	Fertiliser certified by SOHISCERT and EU Organic	Published certificate; potato trial combined with EVERGREEN	A (certificate), C (results)
Paulownia ALTIFOLIA®	Fast-growing tree for agroforestry	Website figures; no trial in Oman	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, sources A20 to A27.

A market-gardening training institute in France is among our pilot trials with ECOSORB® and ECOFERT®. It is a field reference, not statistical evidence (level C).

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

2. Oman in figures

Oman has about 5.49 million inhabitants (2025) on 309,500 km², and an economy of 109.6 billion dollars (2025). Agriculture accounts for 2.8% of gross domestic product and 5.9% of jobs. Cropland covers only 129,180 ha, less than half a percent of the territory, and all of it is irrigated.

National benchmarks

Indicator	Value	Year	Source
Population	5.49 million inhabitants	2025	World Bank (A1)
Gross domestic product	109.6 billion current US$	2025	World Bank (A1)
GDP per capita	19,947 US$	2025	World Bank (A1)
Agricultural value added	2.8% of GDP	2025	World Bank (A1)
Agricultural employment	5.9% of jobs	2025	World Bank (A1)
Agricultural land (mostly rangeland)	4.8% of the territory	2024	World Bank (A1)

Indicator	Value	Year	Source
Cropland (arable land and permanent crops)	129,180 ha	2024	FAOSTAT (A4)
Area equipped for irrigation	123,030 ha	2024	FAOSTAT (A4)
Area actually irrigated	107,100 ha	2024	FAOSTAT (A4)
Cultivated area (national statistics)	275,909 feddans, about 115,882 ha	2022	NCSI (A7)
Fertiliser used	341 kg/ha of arable land	2024	World Bank (A1)
Freshwater withdrawals	116.7% of internal resources	2022	World Bank (A1)
Internal water resources	296 m³ per person per year	2022	World Bank (A1)
Average precipitation	125 mm per year	2022	World Bank (A1)
Food exports	4.3% of merchandise exports	2025	World Bank (A1)
Food imports	14.9% of merchandise imports	2025	World Bank (A1)

Source: World Bank, WDI database (A1); FAOSTAT (A4); National Centre for Statistics and Information (A7).

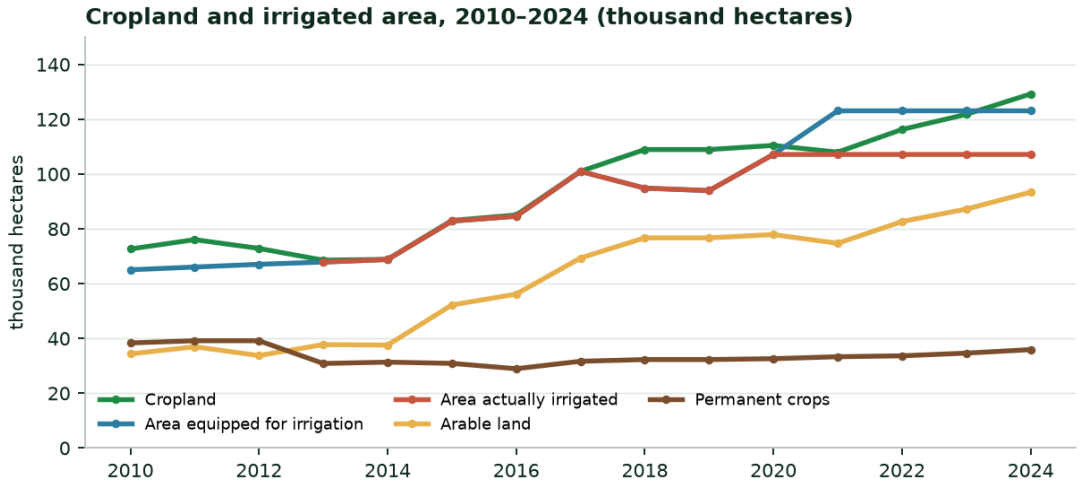


Figure 1. Cropland and irrigated area, 2010–2024 (thousand hectares). Source: FAOSTAT, land use (A4)

Cropland grew from 72.6 thousand hectares in 2010 to 129.2 thousand in 2024 according to FAOSTAT, mainly through arable land. The area equipped for irrigation follows the same path: Every new hectare is a new demand on groundwater.

Three figures for the irrigated area

FAOSTAT gives 123,030 ha equipped for irrigation and 107,100 ha actually irrigated. The national statistics centre (NCSI) counts 275,909 feddans cultivated in 2022, about 115,882 ha, and the ministry reports 293,000 feddans in 2023. The differences come from definitions and dates. The dossier uses the NCSI crop groups to share the water between crops, because they include fodder, which FAOSTAT does not cover.

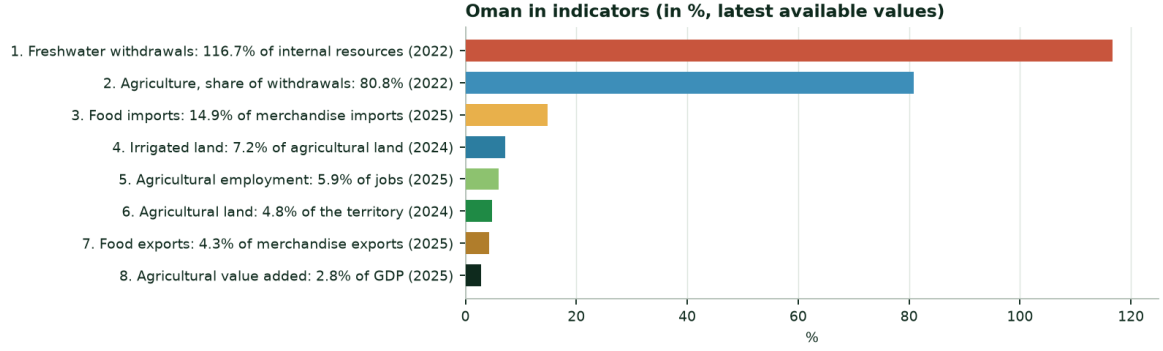


Figure 2. Oman in indicators (in %, latest available values). Source: World Bank (A1)



Misfat al Abriyeen (Ad Dakhiliyah): Terraced fields and date palms below the village, irrigated by a falaj.

3. Sunshine, rainfall and climate change

3.1 Sunshine

Global horizontal irradiation ranges from 2,104 kWh/m² per year at Salalah to 2,307 kWh/m² at Haima (Al Wusta). The whole country receives very strong sunshine: It favours photosynthesis, but also evaporation from soils and crops. The values are those of the main town of each governorate.

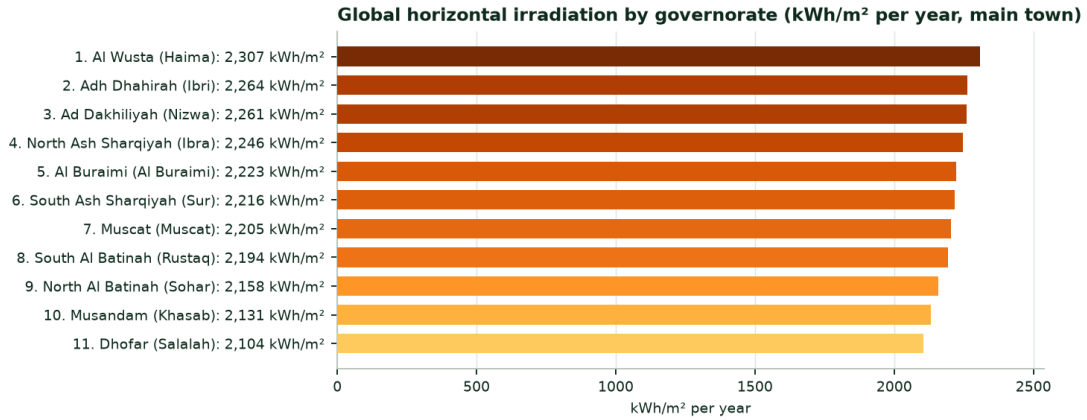


Figure 3. Global horizontal irradiation by governorate (kWh/m² per year, main town). Source: PVGIS 5.2, European Commission (A11); 2005–2020 average

3.2 Rainfall

Rainfall benchmarks

Benchmark	Value	Period	Source (level)
Average precipitation, country	125 mm per year	2022	World Bank (A1, A)
Wettest main town (Khasab, Musandam)	158 mm per year	1991–2020	ERA5-Land (A12, B)
Driest main town (Haima, Al Wusta)	22 mm per year	1991–2020	ERA5-Land (A12, B)
Reference evapotranspiration, Nizwa	2,026 mm per year	1991–2020	ERA5-Land (A12, B)
Reference evapotranspiration, Sohar	2,020 mm per year	1991–2020	ERA5-Land (A12, B)

Source: See the « Source » column.

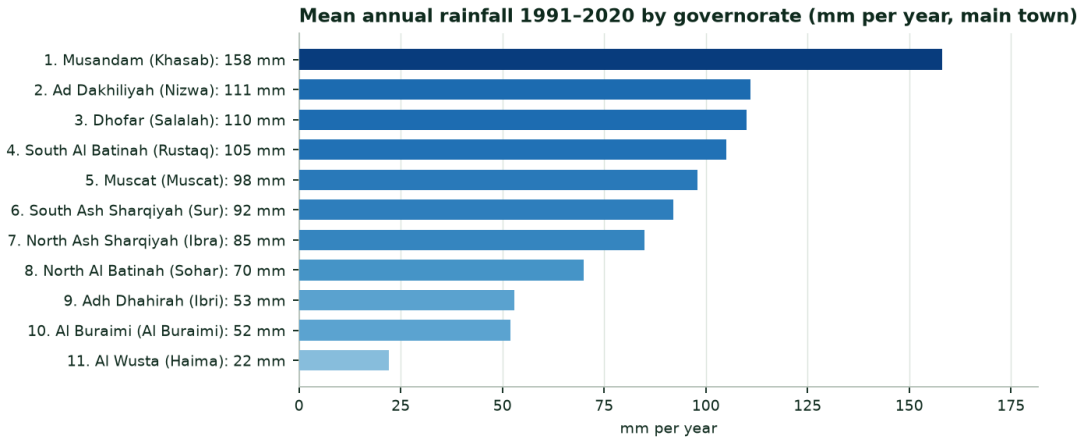


Figure 4. Mean annual rainfall 1991–2020 by governorate (mm per year, main town). Source: ERA5-Land reanalysis, European Centre (A12); author's calculation

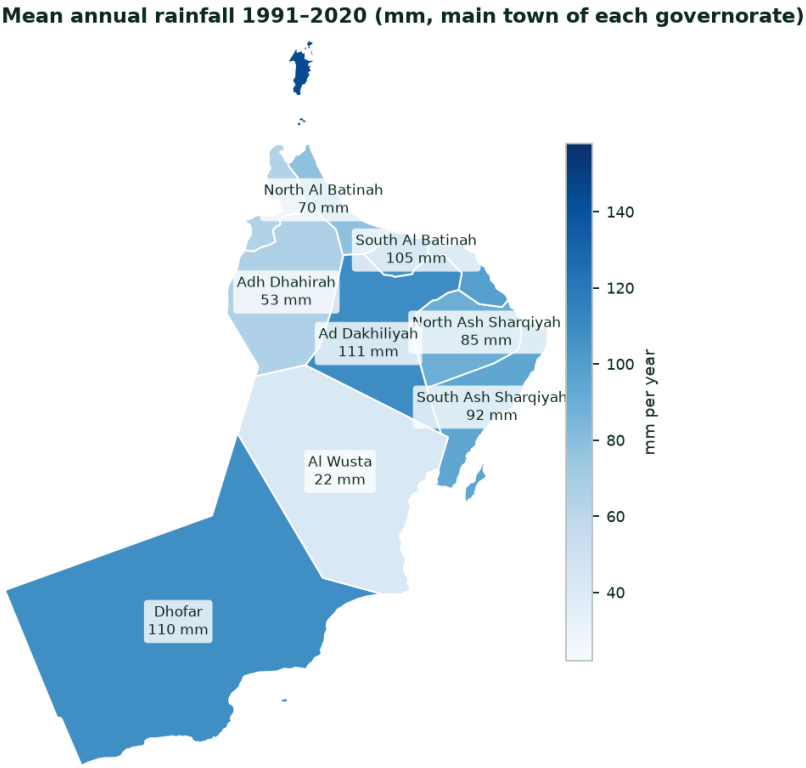


Figure 5. Mean annual rainfall 1991–2020 at the main town of each governorate (mm). Source: ERA5-Land (A12); boundaries Natural Earth, public domain (A19)

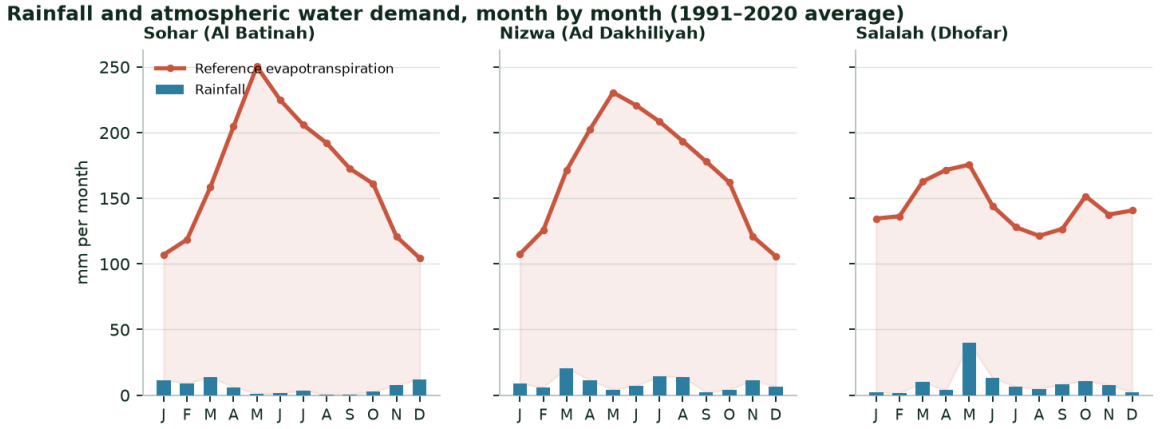


Figure 6. Rainfall and reference evapotranspiration month by month at Sohar, Nizwa and Salalah (mm, 1991–2020 average). Source: ERA5-Land (A12); author's calculation

In every month and every region, the atmosphere demands far more water than the rain provides: 100 to 250 mm per month against a few millimetres. The gap is filled by irrigation. Each cubic metre kept in the root zone, instead of evaporating or draining deep, reduces the water that must be pumped.

What is missing

The official rainfall normals of the Directorate General of Meteorology were not obtained. The values by main town come from a model with a grid of about 9 km. It smooths mountains and does not capture the khareef drizzle of Dhofar (June to September), which official stations record.

3.3 Climate change

Climate models cited in 2025 by the Carnegie Endowment foresee a temperature rise of 2 to 4 °C by 2050 in Oman, with more irregular and reduced rainfall. Most of the territory already receives less than 100 mm per year. Oman's environmental policy is framed by its nationally determined contribution and its National Strategy for Adaptation and Mitigation to Climate Change (2020–2040).

Climate risks for agriculture

Risk	What is observed or projected	Source (level)
Higher temperatures	+2 to +4 °C by 2050	Carnegie Endowment, 2025 (A18, B)
Rainfall	More irregular and lower	Carnegie Endowment, 2025 (A18, B)
Soil and aquifer salinity	Seawater advancing into the Al Batinah coastal aquifers	Sultan Qaboos University studies (A15, A16, B)
Decline of aflaj	About a quarter of the 4,198 aflaj recorded are no longer active	Ministry figures reported by the press, 2025 (A17, C)
Extreme events	Cyclones and flash floods (Gonu 2007, Shaheen 2021)	Public record

Source: See the « Source » column.

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

Agriculture is by far the main water user in Oman. Most irrigation water is groundwater, pumped from wells or carried by aflaj, the traditional channels that bring water from aquifers and springs to the villages. Surface water is rare and comes in short floods.

4.1 Volumes withdrawn

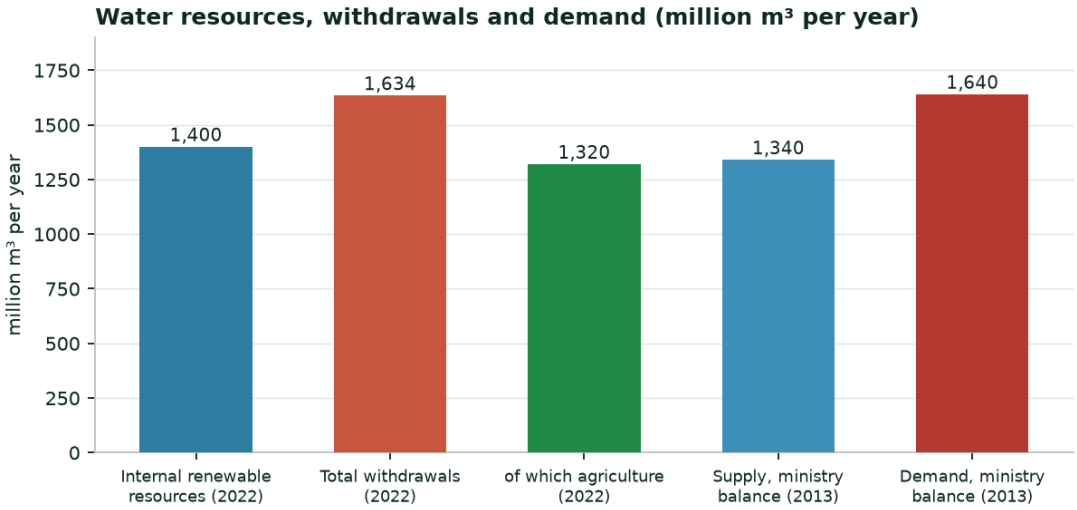


Figure 7. Water resources, withdrawals and demand (million m³ per year). Source: World Bank (A1); ministry water balance 2013 (A14)

Water volumes, in million m³ per year

Estimate	Agriculture	Total	Source (level)
Withdrawals 2022	1,320 (81%)	1,634	World Bank and AQUASTAT (A1, A)
Internal renewable resources 2022	—	1,400	World Bank and AQUASTAT (A1, A)
Ministry water balance 2013, supply	—	≈ 1,340	Ministry presentation (A14, B)
Ministry water balance 2013, demand	83 to 92 % of conventional resources	≈ 1,640	Ministry presentation (A14, B)
Water supplied by active aflaj	Irrigation and villages	≈ 552	Press, 2025 (A17, C)

Source: See the « Source » column.

According to the ministry, abstraction exceeds natural recharge by 25 to 30 %. The deficit, about 300 Mm³ per year in 2013, is met by drawing down aquifers. On the Al Batinah coast, the falling water table lets seawater move inland: A 2022 model of Wadi Al Jizi projects a further advance of 0.8 km by 2040 if pumping continues at the current rate (A16, level B).

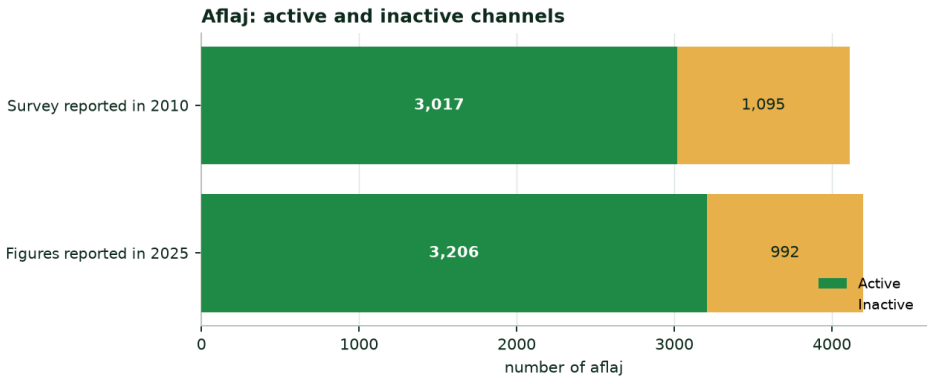


Figure 8. Aflaj: Active and inactive channels. Source: Ministry survey reported in 2010; ministry figures reported by the press in 2025 (A17)

Between the two counts, the number of aflaj recorded rose from 4,112 to 4,198 and the number of active aflaj from 3,017 to 3,206. About a quarter of the aflaj still carry no water. Where a falaj weakens, farms turn to wells, which adds to the pressure on aquifers.

4.2 Irrigated area and water per hectare

Divided by the 115,882 ha cultivated in 2022, the 1,320 Mm³ of agricultural water represent about 11,391 m³ per hectare per year. Date palms and fodder use more than this average, vegetables less: The dossier keeps the average, which understates the weight of date palms.

Irrigation benchmarks

Benchmark	Value	Year	Source (level)
Area equipped for irrigation	123,030 ha	2024	FAOSTAT (A4, A)
Area actually irrigated	107,100 ha	2024	FAOSTAT (A4, A)
Cultivated area (crop groups)	275,909 feddans, 115,882 ha	2022	NCSI (A7, A)
Water per cultivated hectare (calculation)	11,391 m³	2022	Calculation: A1 ÷ A7
Share of the equipped area in Al Batinah	57 %	1993	FAO country profile (A4, A)

Source: See the « Source » column.



Wakan (South Al Batinah): Terraces and palm groves above Wadi Mistal.

4.3 Water prices

No price for agricultural water was found in the sources consulted: Farms pump groundwater from their own wells, and aflaj water is shared by traditional rights. The real cost of a cubic metre is the cost of pumping, and, at the margin, the cost of the desalinated water that cities increasingly use instead of groundwater.

Reference prices for water

Reference	Price	Context	Source (level)
Agricultural groundwater	No tariff found	Pumped from private wells	Sources consulted
Desalinated water, production	About 0.4 OMR per m³ (≈ 1.04 $)	Comparison in a ministry presentation	Ministry presentation (A14, B)

Reference	Price	Context	Source (level)
Barka I plant, variable charge	0.050 OMR per m³, plus a capacity charge	Bulk supply tariff, 2009	Nama PWP (A13b, A)

Source: See the « Source » column.

To value the water saved, the dossier therefore uses three reference values: 0.25, 0.50 and 1.00 US dollar per m³. The highest is close to the cost of desalinated water. They are assumptions, not official tariffs.

4.4 Public investment

Water and agriculture programmes

Programme	Purpose	Period	Source (level)
Recharge dams	Capture flash floods to recharge aquifers; new dams announced in North Ash Sharqiyah in 2024	Ongoing	Press (A17, C)
Aflaj maintenance	Repair and protection of aflaj; 34 aflaj maintained in one recent programme	Ongoing	Press (A17, C)
Relocating fodder	Phase out Rhodes grass in the Al Batinah and Salalah plains, develop the Najd	Since the 2000s	Sultan Qaboos University (A15, B)
Land for reclamation	5.5 million feddans identified as suitable for agriculture	2023	Ministry annual report (A10, B)
Oman Vision 2040	Food security and diversification of the economy	2021–2040	Ministry annual report (A10, B)

Source: See the « Source » column.

4.5 Scarcity and salinity

Scarcity in Oman is structural rather than seasonal: Aquifers are over-drawn every year. The visible signs are salinity in coastal wells, falling flows in aflaj, and abandoned farms on the Al Batinah coast. Reducing the water applied per tree or per plant, without losing yield, is one of the few levers that act at the farm itself.



Wadi channels in the interior of Oman, photographed from the International Space Station.

5. Fertilisers: Quantities, prices, spending

5.1 Quantities used

Omani agriculture used 12,821 t of nitrogen (N), 2,760 t of phosphate (P_2O_5) and 16,210 t of potash (K_2O) in 2024. Oman is at the same time a large producer of nitrogen fertiliser: 1.64 million tonnes of N in 2024, almost all exported (1.64 Mt). Phosphate and potash are imported.

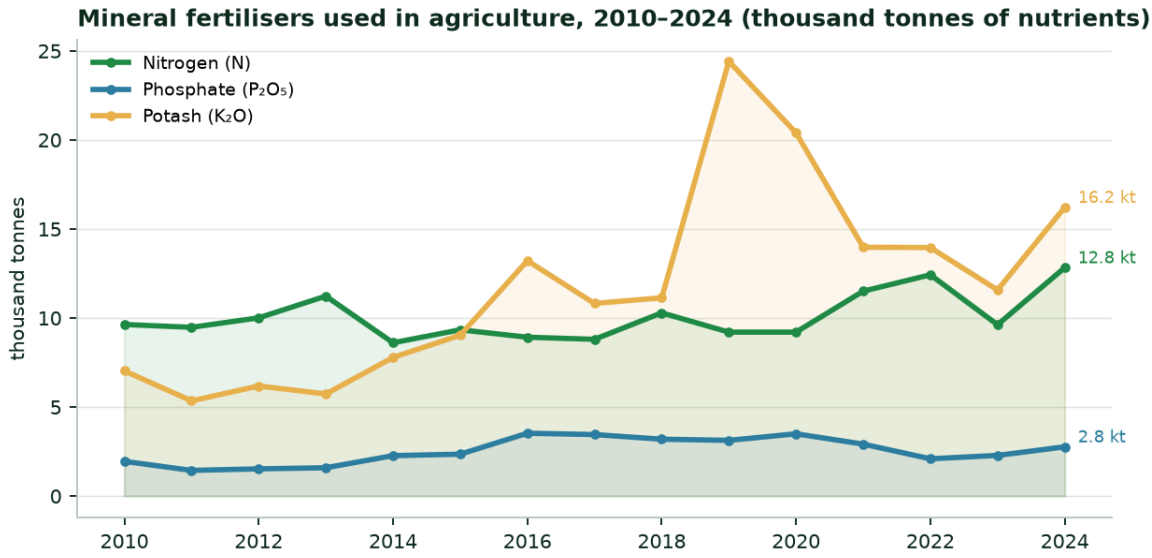


Figure 9. Mineral fertilisers used in agriculture, 2010–2024 (thousand tonnes of nutrients). Source: FAOSTAT, fertilisers by nutrient (A5)

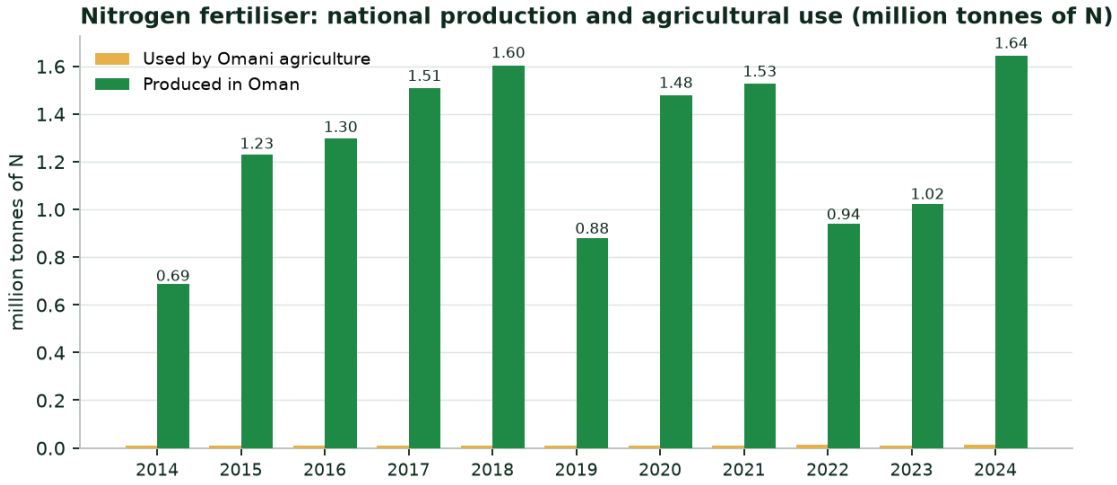


Figure 10. Nitrogen fertiliser: National production and agricultural use (million tonnes of N). Source: FAOSTAT (A5)

Fertilisers used, in tonnes of nutrients

Year	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)	N produced
2019	9,200	3,124	24,410	881,002
2020	9,200	3,491	20,393	1,479,934
2021	11,500	2,911	13,969	1,526,672
2022	12,420	2,088	13,951	939,335
2023	9,615	2,277	11,568	1,022,814
2024	12,821	2,760	16,210	1,642,943

Source: FAOSTAT (A5).

5.2 Prices

International fertiliser prices doubled in 2021–2022, then fell back. In 2024, urea was worth 338 dollars per tonne and potassium chloride 295 dollars. Prices paid by Omani farmers, including transport and margins, are higher.

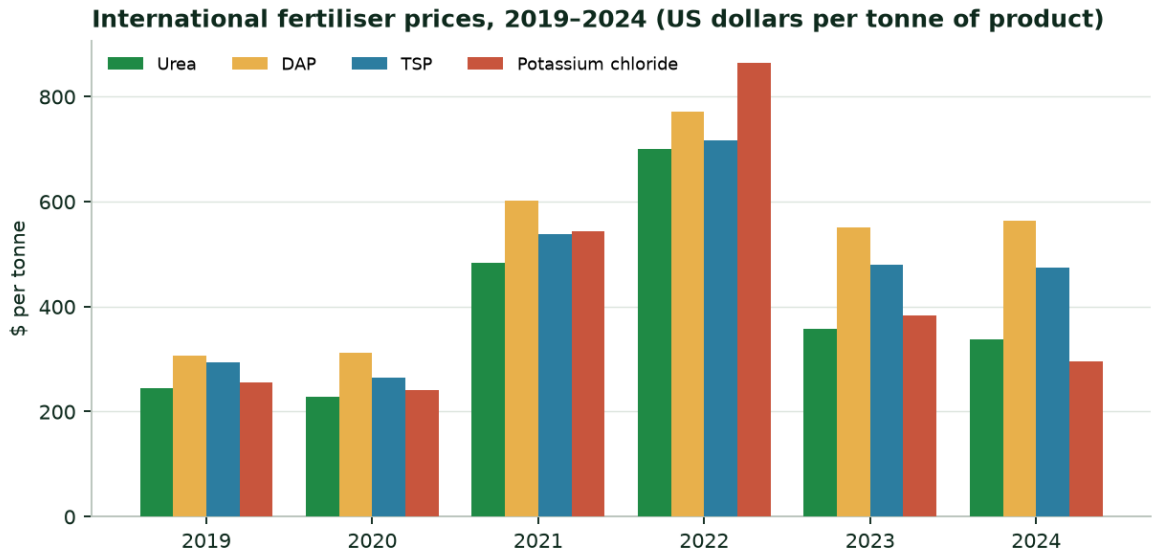


Figure 11. International fertiliser prices, 2019–2024 (US dollars per tonne of product). Source: World Bank, Commodity Price Data (A13)

International prices, in US dollars per tonne

Year	Urea	DAP	TSP	Potassium chloride
2019	245	306	294	256
2020	229	312	265	241
2021	483	601	538	543
2022	700	772	716	863
2023	358	550	480	383
2024	338	564	475	295

Source: World Bank (A13), annual averages.

5.3 Indicative spending

Converted into urea, triple superphosphate and potassium chloride, the nutrients used represent spending of at least 20.2 million dollars in 2024, and 42.2 million in 2022, the year of the price peak.



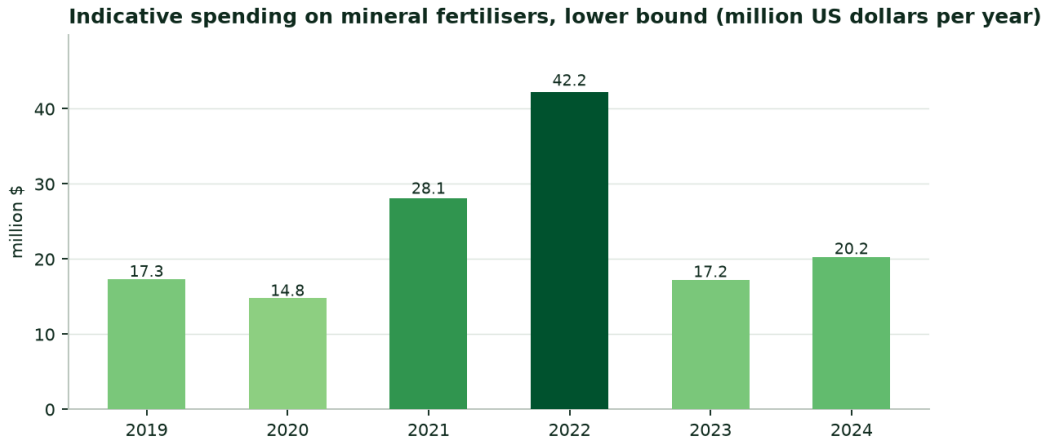


Figure 12. Indicative spending on mineral fertilisers, lower bound (million US dollars per year). Source: Author's calculation from A5 and A13

Limits of the calculation

- International prices, without transport, duties or margins: Real spending is higher.
- Compound and foliar fertilisers are not distinguished.
- In sandy soils, a large share of fertiliser is lost below the roots with irrigation water; this loss is not quantified here.

6. By governorate

The cultivated area by governorate is not published in the sources consulted after the 2012–2013 agricultural census, when North and South Al Batinah held about 37 % of the cultivated area. Date production and the wheat area are published by governorate and show where agriculture weighs most.

Climate, dates and wheat by governorate

Governorate	Main town	Radiation (kWh/m²/yr)	Rainfall (mm/yr)	Dates 2022 (t)	Share of dates	Wheat 2022/23 (feddans)
Ad Dakhiliyah	Nizwa	2,261	111	90,200	23.9%	779.0
North Al Batinah	Sohar	2,158	70	57,923	15.4%	41.1
South Al Batinah	Rustaq	2,194	105	54,715	14.5%	57.0
North Ash Sharqiyah	Ibra	2,246	85	52,586	13.9%	66.5
Adh Dhahirah	Ibri	2,264	53	46,204	12.3%	245.0
South Ash Sharqiyah	Sur	2,216	92	30,237	8.0%	9.5
Al Buraimi	Al Buraimi	2,223	52	19,257	5.1%	33.2
Muscat	Muscat	2,205	98	12,832	3.4%	3.0
Dhofar	Salalah	2,104	110	6,584	1.7%	5,112.0
Musandam	Khasab	2,131	158	6,396	1.7%	13.0
Al Wusta	Haima	2,307	22	132	0.0%	—
Oman	—	—	—	**377,066**	**100.0%**	**6,359.4**

Source: PVGIS (A11); ERA5-Land (A12); NCSI (A8); Ministry of Agriculture, Fisheries and Water Resources (A9).

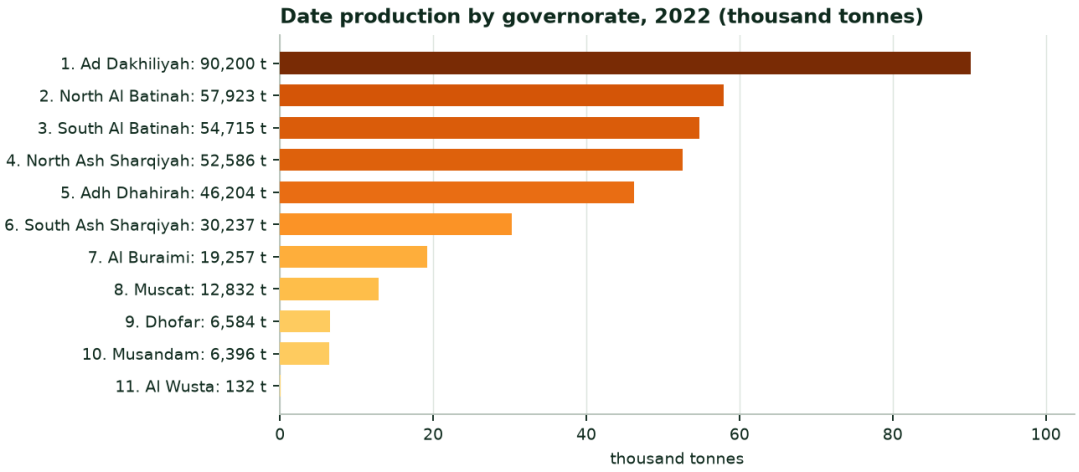


Figure 13. Date production by governorate, 2022 (thousand tonnes). Source: NCSI (A8)

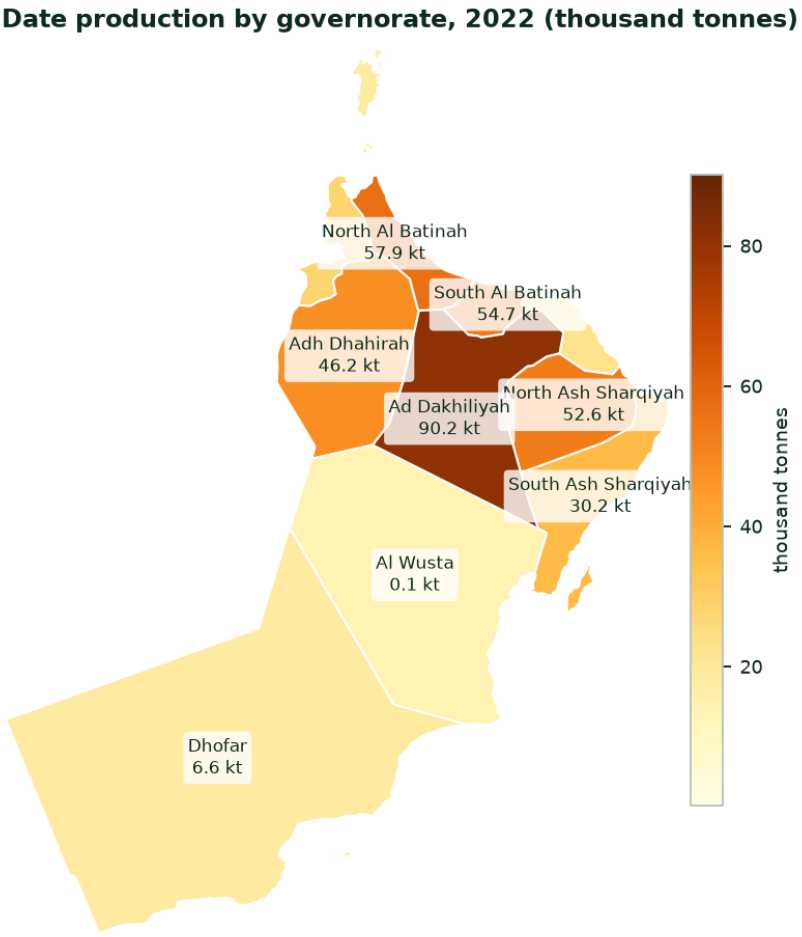


Figure 14. Date production by governorate, 2022 (thousand tonnes). Source: NCSI (A8); boundaries Natural Earth, public domain (A19)

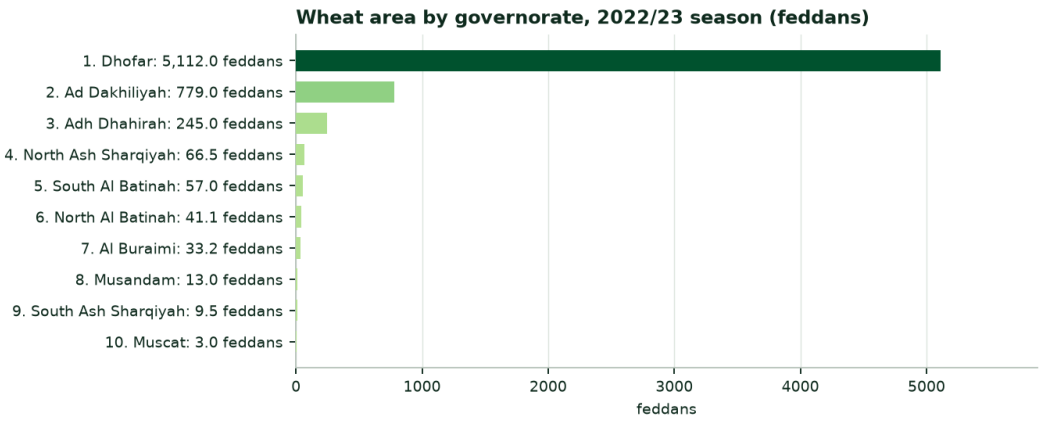


Figure 15. Wheat area by governorate, 2022/23 season (feddans). Source: Ministry of Agriculture, Fisheries and Water Resources (A9)

Reading by governorate

• **Ad Dakhiliyah**: First date producer (24% of national output), oases irrigated by aflaj and wells at the foot of the Hajar mountains. The first target for date palm trials.

• **North and South Al Batinah**: The coastal plain, historically the main farming area: Dates, vegetables, limes, fodder. Groundwater is over-drawn and seawater is advancing: Water savings matter most here.

• **North and South Ash Sharqiyah, Adh Dhahirah, Al Buraimi**: Interior oases, dates and vegetables, very low rainfall.

• **Dhofar**: Monsoon climate on the coast, fodder and coconuts; 80% of the national wheat area in 2022/23, in the Najd.

• **Muscat, Musandam, Al Wusta**: Small farm areas; Al Wusta is the driest governorate.



Bilad Sayt (Al Hamra, Ad Dakhiliyah): Terraced fields and date palms at the foot of the mountains.

7. The twenty main crops: Three rankings

Three rankings complement each other: Area, production and value. Because all crops in Oman are irrigated, the area ranking also gives the irrigated area; the dossier therefore adds a ranking by production. FAOSTAT does not cover fodder crops, which national statistics place first.

7.1 By area

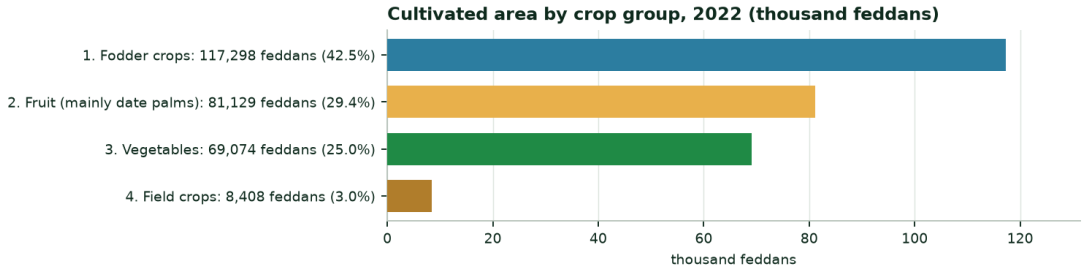


Figure 16. Cultivated area by crop group, 2022 (thousand feddans). Source: NCSI, reported by the press (A7)

Twenty main crops by harvested area (2023)

Rank	Crop	Area (ha)	Production (t)	Yield (t/ha)
1	Dates	26,698	394,946	14.8
2	Other fresh vegetables	18,815	446,181	23.7
3	Sorghum (fodder)	3,234	182,373	56.4
4	Wheat	3,003	7,892	2.6
5	Tomatoes	2,848	225,488	79.2
6	Limes and lemons	1,920	9,189	4.8
7	Other fruit	1,901	41,698	21.9
8	Melons	1,870	49,943	26.7
9	Bananas	1,573	18,432	11.7
10	Mangoes and guavas	1,553	16,149	10.4
11	Cauliflower and broccoli	1,454	31,041	21.3
12	Chillies and green peppers	1,318	166,943	126.7
13	Cabbages	1,134	43,300	38.2
14	Watermelons	1,070	41,445	38.7
15	Other cereals (fodder)	779	31,738	40.7
16	Pumpkins and squash	750	19,467	26.0
17	Carrots and turnips	658	30,322	46.1
18	Coconuts	637	6,733	10.6
19	Okra	558	7,567	13.6
20	Dry onions	504	17,197	34.1

Source: FAOSTAT, crop production 2023 (A2); aggregates excluded. Sorghum and « other cereals » are grown as green fodder.

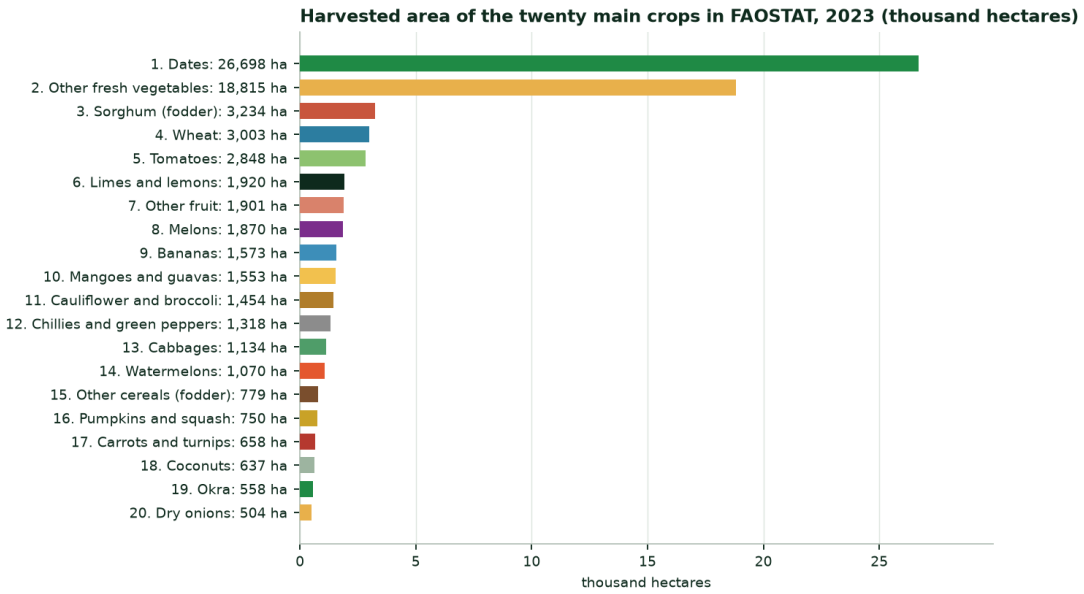


Figure 17. Harvested area of the twenty main crops in FAOSTAT, 2023 (thousand hectares). Source: FAOSTAT (A2)

7.2 By production

In tonnes, dates come first (394,946 t in 2023 according to FAOSTAT), followed by fresh vegetables, tomatoes, green fodder sorghum and peppers. Vegetables yield high tonnages on small areas, often in greenhouses.

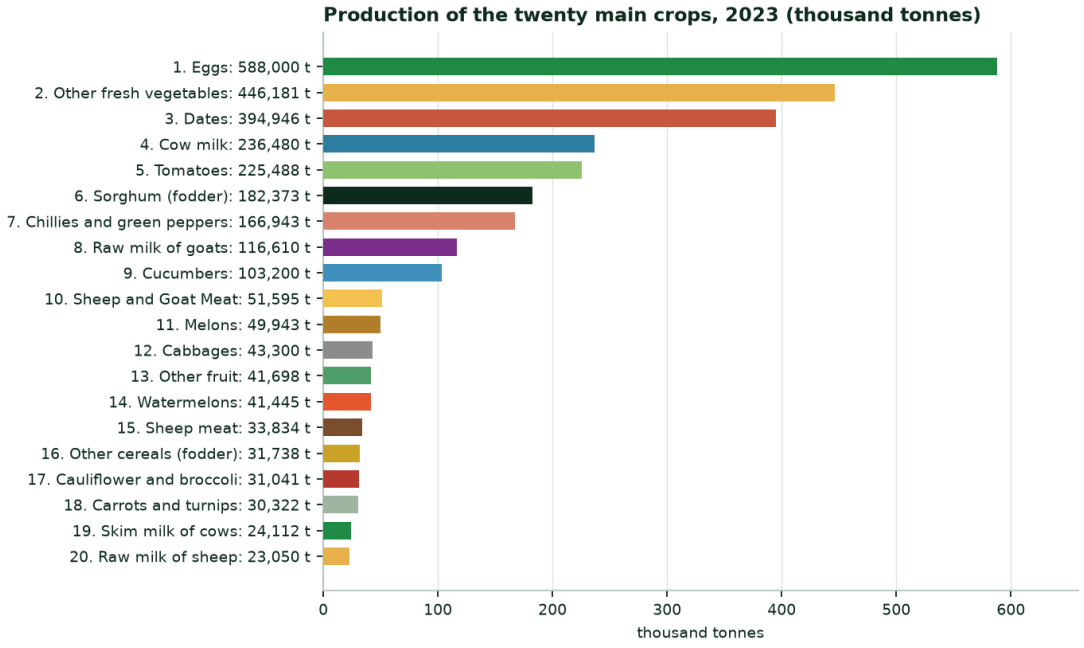


Figure 18. Production of the twenty main crops, 2023 (thousand tonnes). Source: FAOSTAT (A2)

7.3 By value of production

In value, dates come first by a wide margin, with 40% of the value of all crops, followed by vegetables, peppers and tomatoes. The total reaches 0.97 billion international dollars in 2023 (constant 2014–2016 prices).

Value of production by crop (2023, constant 2014–2016 prices)

Rank	Crop	Value (million international $)	Share of crops

Rank	Crop	Value (million international $)	Share of crops
1	Dates	383.9	39.7%
2	Other fresh vegetables	132.6	13.7%
3	Chillies and green peppers	112.0	11.6%
4	Tomatoes	107.4	11.1%
5	Sorghum (fodder)	39.6	4.1%
6	Cucumbers	38.6	4.0%
7	Melons	18.7	1.9%
8	Other fruit	17.9	1.8%
9	Cauliflower and broccoli	14.6	1.5%
10	Mangoes and guavas	10.1	1.1%
11	Cabbages	9.9	1.0%
12	Watermelons	9.6	1.0%
13	Other cereals (fodder)	9.2	1.0%
14	Carrots and turnips	8.4	0.9%
15	Dry onions	7.2	0.7%
16	Okra	7.2	0.7%
17	Bananas	6.6	0.7%
18	Pumpkins and squash	5.6	0.6%
19	Green garlic	5.5	0.6%
20	Limes and lemons	5.3	0.6%

Source: FAOSTAT, value of agricultural production (A3).

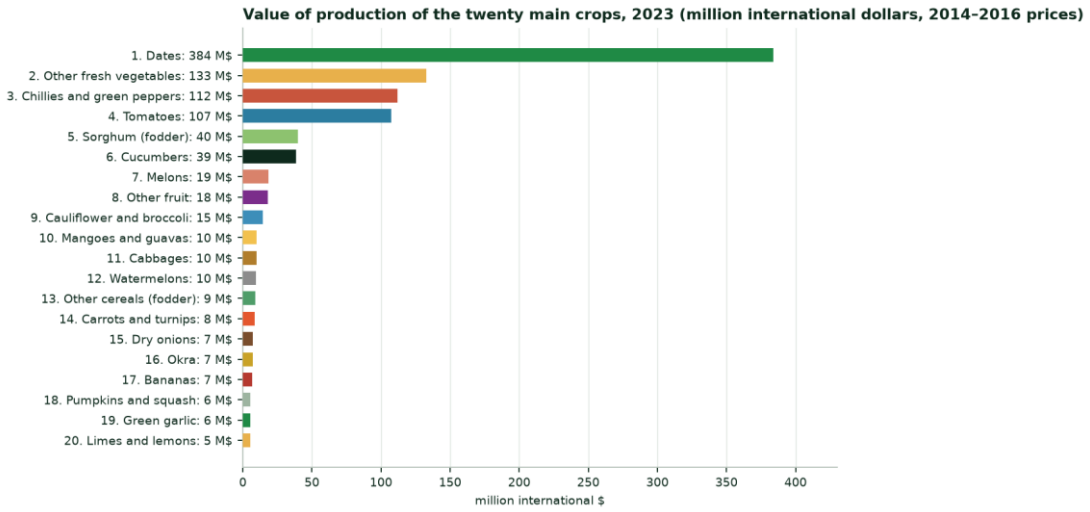


Figure 19. Value of production of the twenty main crops, 2023 (million international dollars). Source: FAOSTAT (A3)



Bunches of ripening dates.

8. Extrapolation by crop and water savings

8.1 Method

Method in brief

• **Agricultural water**: 1,320 million m³ per year (World Bank, 2022), shared between crop groups according to their share of the cultivated area (NCSI, 2022).

• **Water saving**: For each crop group, a quarter (cautious), half (central) or all (strong) of the saving measured in the closest trial. Without a trial, 5, 10 or 20 %.

• **Yield gain**: Same rule, applied to FAOSTAT 2023 average yields and valued at constant 2014–2016 prices.

• **Value of water**: 0.25, 0.50 or 1.00 US dollar per m³ (section 4.3).

• **What the calculation does not contain**: No product price, no application cost.

8.2 Trials used as analogues

Trials cited and their use in the calculation

Trial	Published water saving	Published yield gain	Use in this dossier	Level
Date palm, UAE (ICBA, 2020–2021)	−82 %	+20 %	Date palms	B
Watermelon, Mexico (2023)	−60.5 %	+30 %	Vegetables and melons	C
Soybean, China (Shandong)	Not measured	+11.2 to 11.4 %	Yield of field crops	B
Maize, Turkey (TIGEM, 2025)	−39 %	+17.1 %	Not used (little grain maize in Oman)	C
Potato, South Africa (2025–2026)	−52 %	+31.4 %	Not used separately (included in vegetables)	C

Source: Trials published on the Green Solutions website (A20 to A24).

The ICBA trial is the most relevant for Oman: 27 date palms about eight years old, in sandy and saline soil at Dubai, a climate with about 50 mm of rain per year. EVERGREEN was mixed into the top 50 cm of soil;

irrigation was driven by soil-moisture probes. The treated trees used 82 % less irrigation water over the season, showed no sign of stress, and gave 20 % more dates at the 300 g dose.

8.3 Parameters by crop group

Water saving and yield gain used, by scenario (cautious / central / strong)

Group	Analogue	Water	Yield
Date palms	Date palm, UAE (ICBA, 2020-2021)	20.5% / 41.0% / 82.0%	5.0% / 10.0% / 20.0%
Fodder crops (Rhodes grass, alfalfa, fodder sorghum)	Generic assumption, no trial	5.0% / 10.0% / 20.0%	—
Other fruit (limes, bananas, mangoes…)	Generic assumption, no trial	5.0% / 10.0% / 20.0%	—
Vegetables and melons	Watermelon, Mexico (2023)	15.1% / 30.2% / 60.5%	7.5% / 15.0% / 30.0%
Field crops (wheat, barley…)	Water: Generic assumption; yield: Soybean, China	5.0% / 10.0% / 20.0%	2.8% / 5.7% / 11.3%

Source: Author's calculation (Annex B).

8.4 National results

293 Mm³
Of water saved per year in the central scenario (22% of agricultural water).

147 to 586
Million m³ per year, from the cautious to the strong scenario.

207,000 t
Of additional production in the central scenario (vegetables, dates, field crops).

Water saved and value per year, by scenario and value of water

Scenario	Water saved (Mm³/yr)	Share of agricultural water	Water at 0.25 $ (M$)	Water at 0.50 $ (M$)	Water at 1.00 $ (M$)	Yield (M$)
Cautious	147	11.1%	36.6	73.3	146.6	52.1
Central	293	22.2%	73.3	146.6	293.2	104.2
Strong	586	44.4%	146.6	293.2	586.4	208.4

Source: Author's calculation (Annex B).

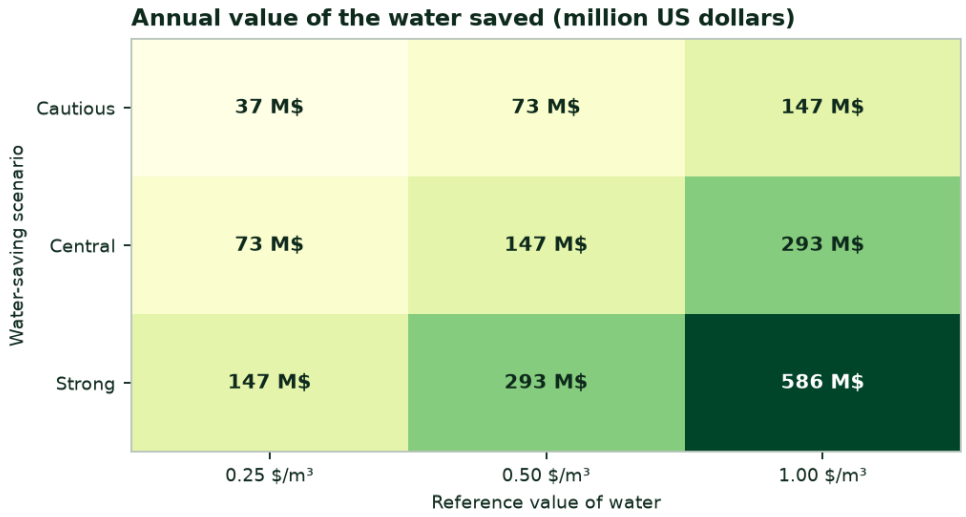


Figure 20. Annual value of the water saved (million US dollars), by scenario and value of water. Source: Author's calculation

In the central scenario, the total value reaches about 251 million dollars per year: 147 million for water at 0.50 $/m³, and 104 million for the yield gain.

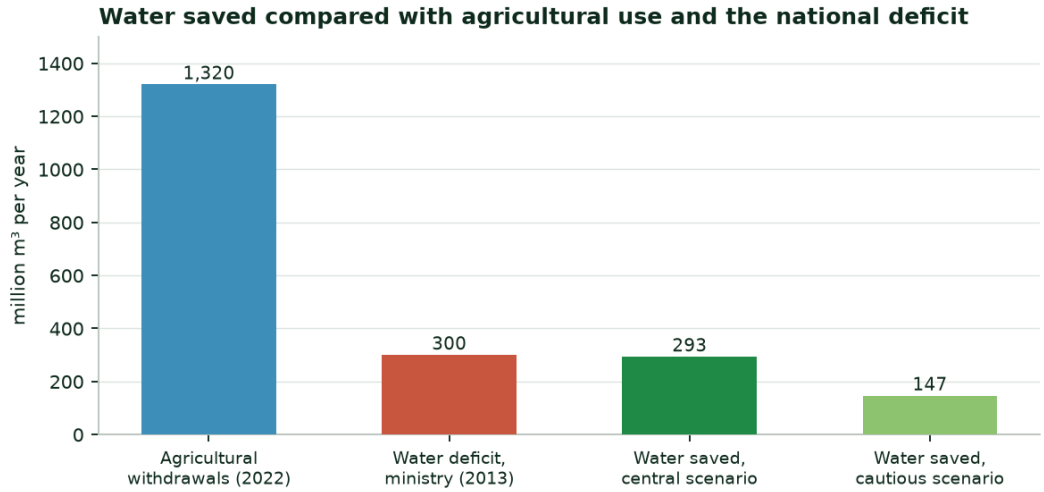


Figure 21. Water saved compared with agricultural withdrawals and the 2013 national deficit (million m³ per year). Source: World Bank (A1); ministry (A14); author's calculation

8.5 Water saved by crop (central scenario)

Water saved by crop group (central scenario)

Group	Share of cultivated area	Water used (Mm³/yr)	Water saved (Mm³/yr)	Yield gain (t)
Date palms	23.0%	304	124.7	39,495
Vegetables and melons	25.0%	330	100.0	166,687
Fodder crops (Rhodes grass, alfalfa, fodder sorghum)	42.5%	561	56.1	—
Other fruit (limes, bananas, mangoes…)	6.4%	84	8.4	—
Field crops (wheat, barley…)	3.0%	40	4.0	524

Source: Author's calculation (Annex B).

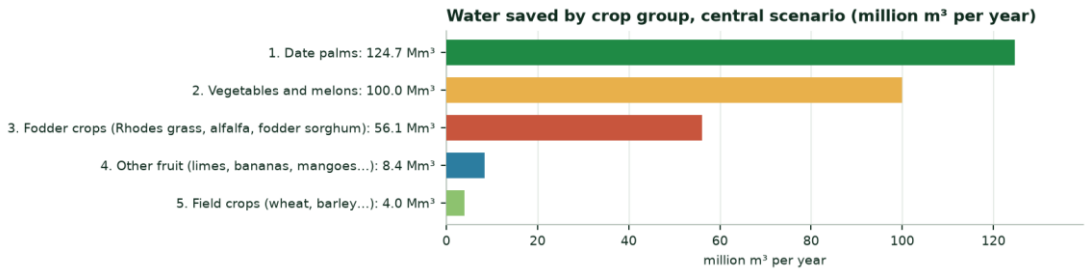


Figure 22. Water saved by crop group, central scenario (million m³ per year). Source: Author's calculation

The same calculation, crop by crop, uses the FAOSTAT 2023 areas and the NCSI fodder area. Because the two sources differ slightly, the total differs a little from the total by group.

Water saved by crop, central scenario (twenty first crops)

Rank	Crop	Area (ha)	Water used (Mm³/yr)	Saving rate	Water saved (Mm³/yr)	Analogue
1	Dates	26,698	304.1	41.0%	124.7	Date palm, UAE
2	Other fresh vegetables	18,815	214.3	30.2%	64.8	Watermelon, Mexico
3	Fodder crops (Rhodes grass, alfalfa, fodder sorghum)	49,265	561.2	10.0%	56.1	Generic
4	Tomatoes	2,848	32.4	30.2%	9.8	Watermelon, Mexico
5	Melons	1,870	21.3	30.2%	6.4	Watermelon, Mexico

Rank	Crop	Area (ha)	Water used (Mm³/yr)	Saving rate	Water saved (Mm³/yr)	Analogue
6	Cauliflower and broccoli	1,454	16.6	30.2%	5.0	Watermelon, Mexico
7	Chillies and green peppers	1,318	15.0	30.2%	4.5	Watermelon, Mexico
8	Cabbages	1,134	12.9	30.2%	3.9	Watermelon, Mexico
9	Watermelons	1,070	12.2	30.2%	3.7	Watermelon, Mexico
10	Wheat	3,003	34.2	10.0%	3.4	Generic (yield: Soybean)
11	Pumpkins and squash	750	8.5	30.2%	2.6	Watermelon, Mexico
12	Carrots and turnips	658	7.5	30.2%	2.3	Watermelon, Mexico
13	Limes and lemons	1,920	21.9	10.0%	2.2	Generic
14	Other fruit	1,901	21.7	10.0%	2.2	Generic
15	Okra	558	6.4	30.2%	1.9	Watermelon, Mexico
16	Bananas	1,573	17.9	10.0%	1.8	Generic
17	Mangoes and guavas	1,553	17.7	10.0%	1.8	Generic
18	Dry onions	504	5.7	30.2%	1.7	Watermelon, Mexico
19	Aubergines	480	5.5	30.2%	1.7	Watermelon, Mexico
20	Potatoes	438	5.0	30.2%	1.5	Watermelon, Mexico

Source: FAOSTAT 2023 (A2); NCSI 2022 for fodder (A7); author's calculation (Annex B).

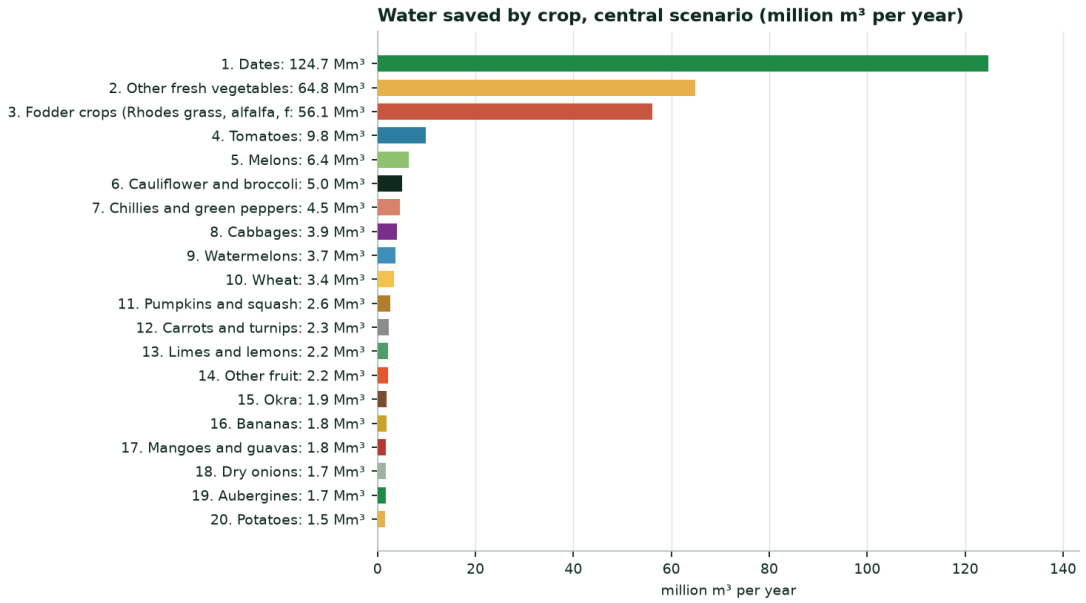


Figure 23. Water saved by crop, central scenario (million m³ per year). Source: Author's calculation

8.6 Reading the results

Key points

• The central saving (293 Mm³ per year) is of the same order as the national water deficit estimated by the ministry in 2013 (about 300 Mm³).

• Date palms and vegetables give most of the result, because published trials exist for them. A trial in Oman on

date palms would confirm or correct the main figure.

• Fodder covers the largest area but relies on a generic assumption: A trial on Rhodes grass or alfalfa would change the result strongly.

• The calculation uses an average volume per hectare; date palms and fodder use more water than vegetables, so their real weight is probably higher.

9. Potential benefits of our products

The table matches each expected benefit with what has been published, its source and its limit. It contains no yield promise.

Benefits, evidence and limits

Benefit	What is published	Source (level)	Limit
Less irrigation water	−82 % (date palm), −60.5 % (watermelon), −52 % (potato), −39 % (maize)	Green Solutions and ICBA trials (A20 to A24, B to C)	Trials outside Oman, often on a single plot
Yield maintained or increased	+20 % (date palm), +30 % (watermelon), +31.4 % (potato), +17.1 % (maize), +11 % (soybean)	Same trials (B to C)	No statistical replication for most
Resistance to heat and drought	Date palms without visible stress with watering once a week	ICBA (A20, B)	One season, one site
Sandy and saline soils	Trial carried out in sandy, saline soil	ICBA (A20, B)	To be confirmed on Omani soils
Fewer fertiliser losses	Higher nutrient levels in the root zone (date palm)	ICBA (A20, B)	Not quantified as fertiliser saved
Organic fertilisation	ECOFERT® certified by SOHISCERT and EU Organic	Certificate (A25, A)	Agronomic effect not isolated

Source: See the « Source » column.

What this dossier does not include

• The cotton figures from Turkey (+93 % yield): A demonstration under extreme stress, not representative.

• The effects claimed for Water Vital® and NAPEMA®: No independent source in the documents consulted.

• Any product or application price.





Irrigated date palm grove.

10. External trade: Exports and imports

10.1 Overview, 2024

Agricultural trade of Oman

Indicator	2023	2024	Change
Agricultural exports (M$)	1,720	969	-43.7%
Agricultural imports (M$)	4,630	4,117	-11.1%
Agricultural balance (M$)	-2,909	-3,148	—
Share of merchandise exports	—	1.5%	—
Share of merchandise imports	—	9.5%	—

Source: FAOSTAT, trade in agricultural products (A6); sub-totals excluded.

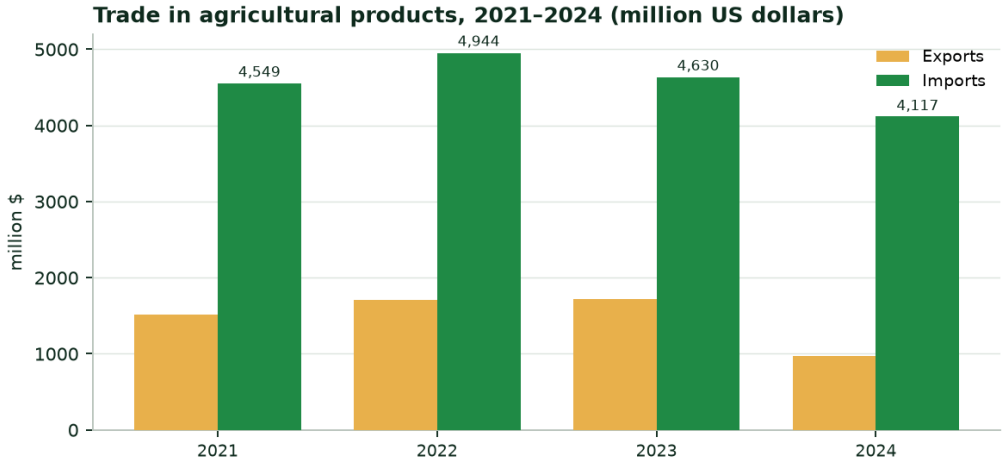


Figure 24. Trade in agricultural products, 2021–2024 (million US dollars). Source: FAOSTAT (A6)

Oman imports about 4.2 times more agricultural products than it exports. Part of the exports are re-exports of processed goods (milk powder, flour, pasta, palm oil) through Omani ports.

10.2 Exports

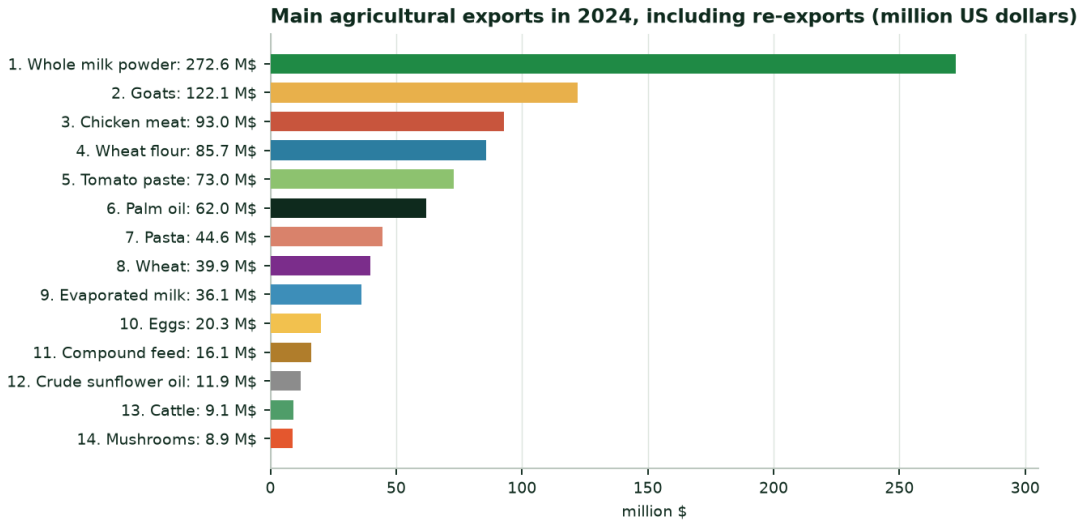


Figure 25. Main agricultural exports in 2024, including re-exports (million US dollars). Source: FAOSTAT (A6)

10.3 Imports

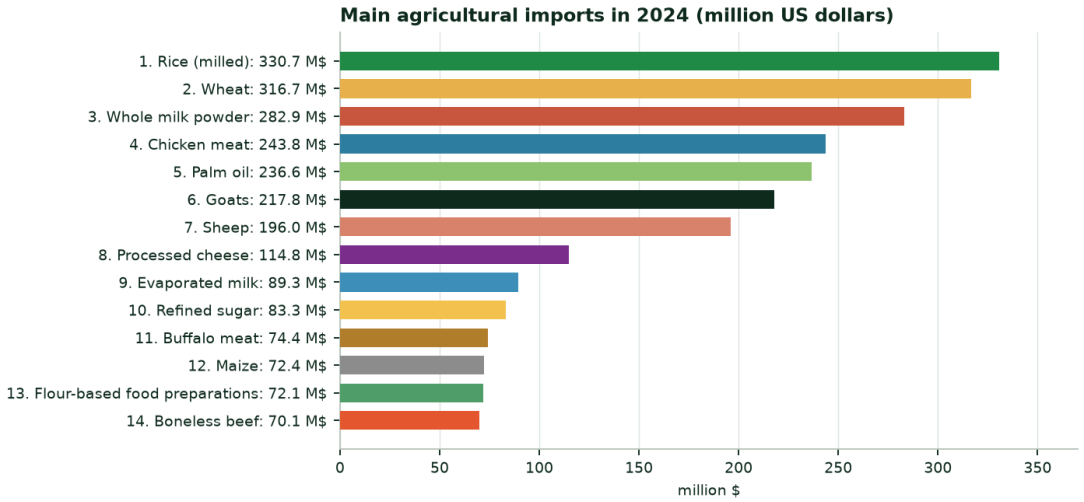


Figure 26. Main agricultural imports in 2024 (million US dollars). Source: FAOSTAT (A6)

Imports of cereals and staple foods, 2024

Product	Volume 2023 (t)	Volume 2024 (t)	Value 2024 (M$)
Wheat	1,021,020	897,798	316.7
Rice (milled)	176,366	324,761	330.7
Maize	234,497	289,369	72.4
Barley	98,541	115,607	33.3
Potatoes	76,759	121,577	45.5
Dry onions	66,371	44,435	23.3
Tomatoes	47,895	59,391	29.6
Dates	16,506	11,005	16.5

Source: FAOSTAT (A6).

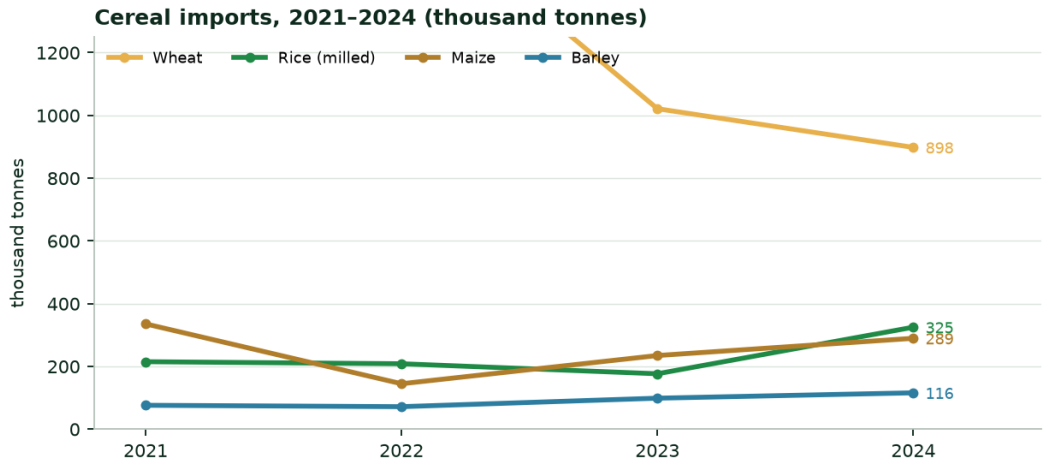


Figure 27. Cereal imports, 2021–2024 (thousand tonnes). Source: FAOSTAT (A6)

Wheat imports fell from 1,021 thousand tonnes in 2023 to 898 thousand in 2024, while rice imports rose to 325 thousand tonnes. Oman grows almost none of these cereals: Its food security in staples rests on imports, and its own water is best used for high-value crops that it grows well.

10.4 Water and imports

Imported wheat (898 thousand tonnes in 2024) is more than a hundred times domestic production. Oman also imports 122 thousand tonnes of potatoes and 59 thousand tonnes of tomatoes, crops that it grows but in insufficient quantity. Each cubic metre saved on existing farms can be used to grow more of these products locally.

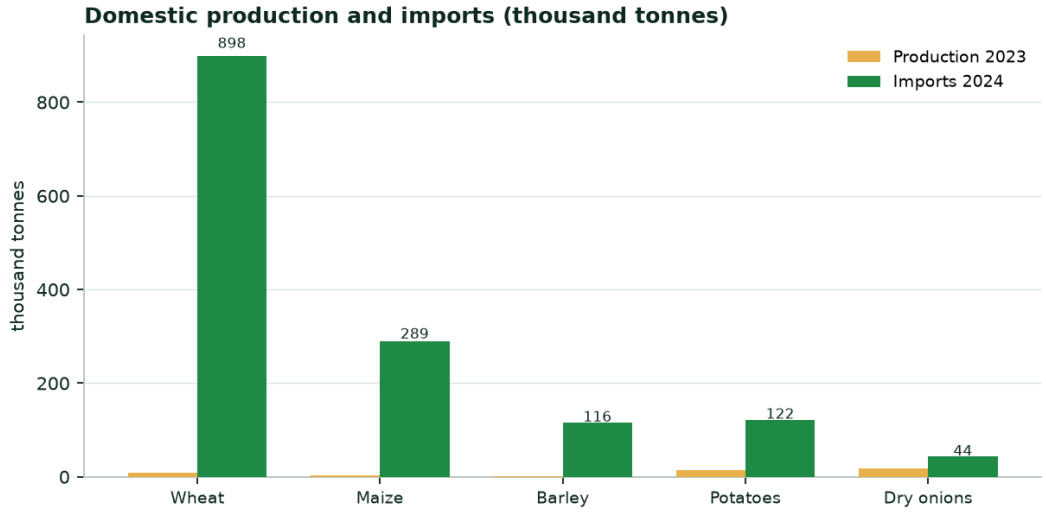


Figure 28. Domestic production (2023) and imports (2024), in thousand tonnes. Source: FAOSTAT (A2, A6)

10.5 Dates

Oman produced 377,066 t of dates in 2022 (NCSI). According to FAOSTAT, it exported 4,557 t and imported 11,005 t in 2024: Most of the harvest is consumed locally or used for processing and animal feed. Higher yields per tree with less water would serve both food security and export ambitions.

11. Limits and points to complete

What remains to be completed

• **Areas by governorate**: The cultivated area by governorate after the 2012–2013 census was not found; the dossier uses date and wheat data by governorate.

• **Water by crop**: The water is shared in proportion to area; date palms and fodder probably use more per hectare than vegetables.

• **Rainfall**: Official normals not obtained; model values do not capture the khareef of Dhofar.

• **Water price**: No tariff for agricultural water; three reference values are used, the highest close to desalination.

• **Feddans**: Areas in feddans are converted at 0.42 ha; the conversion matches FAOSTAT for vegetables (29,011 ha against 29,029 ha).

• **Fertilisers**: International prices, not prices paid in Oman.

• **Trials**: No trial of our products has yet been carried out in Oman; all results are scenarios.

Annex A. Sources and confidence levels

List of sources

Ref.	Source	Publisher or author	Year	Level	Link or reference
A1	World Development Indicators (WDI)	World Bank	2022–2025	A	api.worldbank.org
A2	Crop production (QCL)	FAO, FAOSTAT	2023	A	fao.org/faostat
A3	Value of agricultural production (QV)	FAO, FAOSTAT	2023	A	fao.org/faostat
A4	Land use (RL); FAO country profile	FAO	1993–2024	A	fao.org/faostat
A5	Fertilisers by nutrient (RFN)	FAO, FAOSTAT	2010–2024	A	fao.org/faostat
A6	Trade in agricultural products (TCL)	FAO, FAOSTAT	2023–2024	A	fao.org/faostat
A7	Cultivated area by crop group	NCSI, reported by Times of Oman	2022	A	timesofoman.com
A8	Date production by governorate	NCSI, reported by the Oman News Agency	2022	A	omanobserver.om
A9	Wheat season by governorate	Ministry of Agriculture, Fisheries and Water Resources	2022–2023	A	timesofoman.com
A10	Annual report 2023 (areas, palms, land, workers)	Ministry, reported by Oman Observer	2023	B	omanobserver.om
A11	PVGIS 5.2, monthly radiation	European Commission, JRC	2005–2020	A	re.jrc.ec.europa.eu/pvg_tools
A12	ERA5-Land reanalysis, daily rainfall and evapotranspiration	ECMWF, via Open-Meteo	1991–2020	B	open-meteo.com
A13	Commodity Price Data (Pink Sheet)	World Bank	2019–2024	A	worldbank.org/commodities
A13b	Bulk supply tariff, Barka I	Nama Power and Water Procurement	2009	A	omanpwp.om
A14	Water balance 2013 and desalination cost	Ministry presentation	2013	B	Ministry document
A15	Rhodes grass, groundwater and seawater intrusion	Sultan Qaboos University (Zekri and others)	2007–2014	B	Scientific articles
A16	Seawater intrusion model, Wadi Al Jizi	Scientific article	2022	B	Scientific article
A17	Aflaj, dams and maintenance programmes	Oman Observer, Muscat Daily, Times of Oman	2010–2025	C	Press
A18	Reforming for resilience in Oman	Carnegie Endowment for International Peace	2025	B	carnegieendowment.org
A19	Administrative boundaries	Natural Earth (public domain)	Version 5	A	naturalearthdata.com
A20	Date palms, Dubai	ICBA	2020–2021	B	Green Solutions website, trials

Ref.	Source	Publisher or author	Year	Level	Link or reference
A21	Watermelons, Hermosillo (Mexico)	Green Solutions	2023	C	Green Solutions website, trials
A22	Maize, Konya (Turkey)	Green Solutions, D.I.S. and TIGEM	2025	C	Green Solutions website, trials
A23	Potatoes, Bloemfontein (South Africa)	Afrinest Farm Group	2025–2026	C	Green Solutions website, trials
A24	Soybean, Shandong (China)	Shandong Soil and Fertiliser Institute	Undated	B	Green Solutions website, trials
A25	ECOFERT® certificate	SOHISCERT	Current	A	Green Solutions website
A26	Claimed performance, doses and uses	Green Solutions	2026	C	Green Solutions website
A27	Calculations in this dossier	Author of the dossier	—	—	Annex B

Annex B. Calculation method

Radiation. Sum of the 192 monthly values of horizontal radiation from PVGIS, divided by the number of years (16). Main town of each governorate.

Rainfall and evapotranspiration. Sum of the daily ERA5-Land values from 1991 to 2020 at the main town, divided by 30.

Feddans. One feddan = 0.42 ha. Check: 69,074 feddans of vegetables (NCSI 2022) × 0.42 = 29,011 ha; FAOSTAT gives 29,029 ha for 2023.

Agricultural water. Total withdrawals 2022 (1,634 million m³) × agricultural share (80.8%) = 1,320 million m³.

Water per hectare. Agricultural water ÷ cultivated area 2022 (115,882 ha) = 11,391 m³/ha.

Sharing water between crops. Share of each group in the cultivated area (NCSI 2022: Fodder, fruit, vegetables, field crops; dates from FAOSTAT 2023 within fruit) × agricultural water. The calculation assumes the same water per hectare for all crops.

Water saved. Water used by the group × water saving of the scenario.

Yield gain. Area of the group × FAOSTAT 2023 average yield (t/ha) × yield gain of the scenario.

Value created. Water saved × value of water (0.25, 0.50 or 1.00 $/m³) + yield gain × implicit price (FAOSTAT 2023 value at constant 2014–2016 prices ÷ production).

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

Fertiliser spending. Nitrogen ÷ 0.46 × urea price + phosphate ÷ 0.46 × TSP price + potash ÷ 0.60 × potassium chloride price, at World Bank international prices. It is a lower bound.

General limits. National averages; one coefficient per crop group; same water per hectare for all crops; no product cost is included in the calculations of this dossier.

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