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# WATER FOOTPRINT IN COTTON 2020-2024: A GLOBAL ANALYSIS

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## INTRODUCTION

Water is a vital resource for agriculture, and its efficient use is critical for sustainable crop production. Cotton, like any other crop, has specific water requirements that vary depending on climatic conditions, soil properties, and growth stages. Adequate soil moisture is particularly crucial during critical growth stages, such as flowering and boll formation, where water deficits can severely reduce yields (Pettigrew, 2004).

Rainwater is the main source of water for crops, but its availability is often erratic, leading to soil moisture deficits that necessitate supplemental irrigation. In arid and semi-arid regions, where rainfall is insufficient to meet crop needs, irrigation becomes indispensable. However, even in regions with seemingly adequate rainfall, mismatches between crop water requirements and soil moisture availability can occur due to poor soil conditions, runoff, or seepage. Conversely, excessive rainfall during the crop season, especially under poor drainage conditions, can lead to waterlogging and yield losses (Bange et al., 2004).

A critical challenge in cotton production is the excessive use of irrigation water, where farmers often apply more than the crop requires, resulting in inefficiencies and waste. This study evaluates daily weather parameters to calculate *ETc* (crop evapotranspiration), crop water requirements, effective rainfall, and irrigation water applied, aiming to identify opportunities for optimizing irrigation water use. Since rainfall is a natural resource beyond human control, the focus should be on practical water-saving irrigation strategies within human control. Emphasis should be placed on harvesting and conserving rainwater while enhancing irrigation efficiency through precision technologies to support sustainable cotton production.

## METHODOLOGY

This study analyzed water usage data from 271 cotton-growing states or provinces across 38 major cotton-producing countries over the period 2020–2024. The analysis focused on key parameters, such as irrigated area, yield, effective precipitation (*Pe*), crop evapotranspiration (*ETc*), soil water balance (*St*), critical moisture threshold ($S_{crit}$), irrigation water requirements (*IWR*), irrigation water applied, excess irrigation, irrigation water footprint ($WF_{irri}$), rainwater water footprint ($WF_{rain}$) and the total water footprint ($WF_{total}$).

Daily weather data for the 271 locations was obtained from the World Weather Online API. (https://www.worldweatheronline.com). Crop evapotranspiration (*ETc*) was calculated at daily intervals and subsequently aggregated to monthly values, while other parameters - including effective precipitation (*Pe*), soil water balance (*St*), critical moisture threshold ($S_{crit}$), and irrigation water requirements (*IWR*) - were computed directly at monthly intervals for the 271 locations across 38 countries, using CROPWAT 8.0 (FAO) and the methodologies outlined in FAO Irrigation and Drainage Paper No. 56 (Allen et al., 1998).

Country-wise data on water withdrawals were sourced from the AQUASTAT-FAO database. The total amount of water withdrawals for agriculture was calculated for 2020 and 2021, and projections were made for 2022–2024 using data from 2018–2021 on 'total water withdrawals' and 'agricultural water withdrawal as a percentage of total water withdrawal.' Data on cotton area, irrigated area under cotton, cotton production, types of irrigation methods, and irrigation water applied were collected from government official websites, records and supplemented with insights from interviews with subject matter experts, researchers, and government representatives.

Data on irrigation water withdrawals for cotton cultivation were provided by a few countries based on official estimates. Some countries provided detailed information on the number of irrigations applied per season, approximate quantity of water used per irrigation and the methods used (flood, furrow, sprinkler, and drip), which helped estimate the amount of water applied. Where such data were unavailable, it was assumed that the amount of irrigation water applied exceeded the cotton crop water requirement by a factor of 1 to 1.2 times, accounting for potential losses due to application methods, runoff, and seepage. This assumption accounts for potential

inefficiencies in water application, particularly in systems using less precise irrigation methods such as spate/flood or furrow systems. The amount of water applied through flood irrigation was estimated to be 1.2 times the calculated crop water requirement, while furrow irrigation applied approximately 1.15 times the required amount. In contrast, sprinkler and drip irrigation systems were assumed to apply water precisely aligned with the crop water requirements, reflecting their higher efficiency and precision.

## RESULTS

**Table-1:** Summary of the Water Footprint from 271 Locations Across 38 Cotton-Growing Countries. Data presented as mean ± SE: Average values over five years (2020–2024) with standard error of the mean.

| Metric | Value (Mean ± SE) | Metric | Value (Mean ± SE) |
|---|---|---|---|
| Total Cotton Area (Million Ha) | 31.2 ± 0.2 | % Irrigated Area | 44% ± 0.5 |
| Lint Yield (Kg/ha) | 786 ± 8 | Lint Production (Million Tonnes) | 24.53 ± 0.24 |
| Effective Precipitation (*Pe*) (mm/ha) | 533 ± 21 | Crop Evapotranspiration (ETc, mm/ha) | 470 ± 6 |
| Irrigation Water Requirement (*IWR*) (mm/ha) | 373 ± 5 | Irrigation Water Applied (mm/ha) | 414 ± 6 |
| Water Withdrawal for Agriculture (Trillion L) | 2,155.9 ± 6.3 | Total Water Footprint ($WF_{total}$ L/Kg Lint) | 9,120 ± 301 |
| Total Irrigation Water Applied (Trillion L) | 57.3 ± 1.1 | Irrigation Water Footprint ($WF_{irri}$ L/Kg Lint) | 2,335 ± 32 |
| Effective Rain in Cotton Farms (Trillion L) | 166.5 ± 6.1 | Rainwater Footprint ($WF_{rain}$ L/Kg Lint) | 6,785 ± 311 |

**Footnotes**

- *Pe* = Effective Precipitation (mm/ha): The portion of total rainfall during a crop season that is available for plant use, after accounting for losses due to runoff, evaporation, and deep percolation.
- *ETc* = Crop Evapotranspiration (mm/ha): The total amount of water lost through evaporation from the soil and transpiration from plants during a specific period, typically measured over a crop's growing season.
- *IWR* = Irrigation Water Requirement (mm/ha): The total amount of water needed by a crop to meet its evapotranspiration needs and ensure optimal growth over its growing season.
- 1 mm rainfall = 1 L/m² = 10,000 L/ha
- Total Irrigation Water Applied (Billion Litres): Total volume of irrigation water applied in billion litres.
- Rain Utilized by Cotton (Billion Litres): Total volume of effective precipitation (rainwater) utilized by cotton crops.
- $WF_{irri}$ = Irrigation Water Footprint (L/Kg Lint): Total irrigation water use (litres) ÷ Total lint produced (kg)
- $WF_{rain}$ = Rainwater Footprint (L/Kg Lint): Total 'effective precipitation' water use (litres) ÷ Total lint produced (kg)
- $WF_{total}$ = Total Water Footprint (L/Kg Lint): Total water used (effective precipitation + irrigation water) in litres ÷ Total lint produced (kg)
- Water Withdrawal for Agriculture (FAO) (Billion Litres): 'Total water withdrawal' x '% of agricultural water withdrawal'

Summary results from the data analysis of 271 locations across 38 major cotton-growing countries over five years from 2020 to 2024 are presented in Table 1. The data indicate that the average global cotton area was 31.22 million hectares, with 44.0% (13.8 million hectares) under irrigation. The global average cotton lint production over the five-year period was 24.53 million tonnes, with an average yield of 786 Kg/ha. Cotton occupies 2.92% of the arable land under temporary crops, which totaled 1,082 million hectares (FAOSTAT). Despite this, cotton accounted for only 2.76% of the total irrigation water used by temporary crops in agriculture, which amounted to 2,156 trillion litres (AQUASTAT, FAO). The annual average irrigation water applied was 57.299 trillion litres per season, while the average effective rainwater received in cotton farms was 166.48 trillion litres per season. The annual average water used by the cotton crop was 9,120 litres to produce one kilogram of lint, comprising 6,785 litres/Kg lint from rainwater and 2,335 litres/kg lint from irrigation water. The average annual effective rainfall received in cotton farms was 533 mm (5.33 million litres per hectare), while the average annual crop evapotranspiration (*ETc*) was 471 mm, and the computed crop irrigation water requirement was 373 mm (3.73 million litres per hectare). The estimated annual average irrigation water applied was 414 mm (4.14 million litres per hectare). Tables 2-4 present country-wise data.

In recent decades, cotton farming has increasingly adopted precision irrigation methods like furrow, sprinkler/pivot, and drip irrigation to enhance water efficiency and productivity. Currently, irrigation methods are distributed as follows: 29.7% flood, 43.3% furrow, 7.6% sprinkler/pivot, and 19.4% drip irrigation. This shift reflects efforts to replace inefficient flood irrigation with more water-efficient alternatives, highlighting progress while emphasizing the need for further optimization to minimize water wastage and enhance sustainability in cotton production.

## DISCUSSION

Cotton production is often misrepresented, particularly regarding its water consumption, and is frequently labeled a "thirsty crop" based on calculations of water use efficiency—measured as the total water (rainfall plus irrigation) required to produce one kilogram of lint. This study revealed that the annual average water used to produce one kilogram of cotton lint was 9,120 litres, comprising 6,785 litres/kg lint from rainwater and 2,335 litres/kg lint from irrigation water. While irrigation water is a critical focus in debates on water efficiency and conservation—as it is essential to avoid wastage and excessive use beyond crop needs—the emphasis on total water use (e.g., stating that 9,120 litres of water are required to produce one kilogram of lint) or even rainwater use alone (6,785 litres/kg lint) distorts the narrative. This approach misleads consumers into believing that cotton is unnecessarily water-intensive, which is a flawed argument for several reasons. First, crops and plants have a natural right to utilize rainwater, which is integral to their growth cycle. Second, humans have no control over rainfall, making it unreasonable to criticize a crop for using rainwater, as it is not a resource that can be managed or conserved like irrigation water. Third, excessive rainwater is detrimental to crop health and often leads to lower yields, further complicating the discussion.

Thus, focusing on rainwater use is misleading and serves no practical purpose in assessing water management. Instead, scientific analysis of irrigation water use can help identify regions where inefficiencies exist, enabling the adoption of precision technologies to optimize irrigation, reduce inefficiencies, and improve sustainability. Therefore, the focus should remain on improving irrigation practices rather than conflating the issue with rainwater use, which is both natural and beyond human control.

Studies by Mekonnen and Hoekstra (2010) and Safaya et al. (2016) estimated the global water footprint of cotton at 233 billion cubic meters per year, closely aligning with this study's estimate of 223.78 billion cubic meters per year (2020–2024), with 74.4% from rainwater and 25.6% from irrigation. The commonly cited figure that cotton accounts for 2.6% of global water use (Hoekstra & Chapagain, 2008) is proportionate to its land use, as cotton occupies 2.92% of global arable land under temporary crops and closely aligns with this study's finding that irrigation water in cotton accounts for 2.76% of total agricultural irrigation water use**.** Additionally, 56.0% of global cotton acreage (17.48 million hectares) is rainfed, with zero irrigation, contributing to more than 45.0% (11.04 million tonnes of lint) of the total cotton production (24.53 million tonnes), further countering the "thirsty crop" misconception.

In recent years, water-use efficiency has improved significantly, with traditional flood irrigation increasingly replaced by drip and sprinkler systems. Additionally, growing awareness of regenerative practices—such as no-till farming, cover cropping, mulching, and biochar application—is further enhancing soil moisture retention, reducing runoff, and promoting sustainability, strengthening efforts in water conservation. This study underscores the need to shift the debate on cotton's water use from rainwater inclusion to irrigation optimization. By focusing on irrigation efficiency, stakeholders can achieve higher yields, increased profitability, and improved environmental sustainability, offering a balanced and practical approach to water use in cotton production.

## REFERENCES


Allen, R. G., Pereira, L. S., Raes, D., & Smith, M. (1998). FAO Irrigation and drainage paper No. 56. *Rome: food and agriculture organization of the United Nations*, *56*(97), e156.

AQUASTAT-FAO (2025) https://www.fao.org/aquastat/en/databases/ (Accessed on 7 March 2025)

Bange, M. P., Milroy, S. P., & Thongbai, P. (2004). Growth and yield of cotton in response to waterlogging. *Field crops research*, *88*(2-3), 129-142.

FAO (2015) Measuring Sustainability in Cotton Farming Systems, Rome, Italy, 149pp. http://www.fao.org/3/a-i4170e.pdf

FAOSTAT (2025) https://www.fao.org/faostat/en/#data/RL (Accessed on 7 March 2025)

Hoekstra, A. Y., & Mekonnen, M. M. (2012). The water footprint of humanity. Proceedings of the national academy of sciences, 109(9), 3232-3237.

Hoekstra, A., and Chapagain, A., (2008) Globalization of Water: Sharing the Planet's Freshwater Resources, Blackwells, Oxford, 224pp.

Mekonnen, M. M. and Hoekstra A. Y. (2010). The green, blue, and grey water footprint of crops and derived crop products. Value of Water Research Report Series No. 47. Delft, The Netherlands.

Pettigrew, W. T. (2004). Moisture deficit effects on cotton lint yield, yield components, and boll distribution. *Agronomy Journal*, *96*(2), 377-383.

Safaya, S., Zhang, G., Mathews, R., (2016) Water Footprint Network: Towards Sustainable Water Use In the Cotton Supply Chain, The Hague, The Netherlands, 99pp., https://waterfootprint.org/media/downloads/Assessm__water_footprint_cotton_India.pdf.

**Table-2** Country-wise Irrigation and Water Balance Data. Country-wise Data presented as Average Values of 5 years (2020-2024), with Standard Error of the Mean (Mean ± SE)

| | Crop Area | Lint Yield | Evapotranspiration (*ETc*), Rainwater and Irrigation in Cotton (mm/ha). Mean ± SE | | | | |
|---|---|---|---|---|---|---|---|
| Country | (1000 Ha) Mean ± SE | (Kg/ha) Mean ± SE | Effective Precipitation *(Pe)* | Evapotranspiration (*ETc)* | Irrigation Water Requirement (*IWR*) | Irrigation Water Applied | Excess Irrigation |
| Argentina | 528 ± 41 | 640, ± 29 | 464 ± 12 | 536 ± 16 | 247 ± 21 | 279 ± 23 | 31 ± 2 |
| Australia | 477 ± 55 | 2,179 ± 61 | 571 ± 57 | 335 ± 5 | 71 ± 23 | 79 ± 25 | 8 ± 2 |
| Bangladesh | 35 ± 4 | 539 ± 87 | 1609 ± 148 | 370 ± 10 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Benin | 582 ± 26 | 483 ± 14 | 654 ± 63 | 452 ± 5 | 149 ± 9 | 179 ± 10 | 30 ± 2 |
| Brazil | 1,674 ± 102 | 1,746 ± 47 | 589 ± 41 | 415 ± 18 | 120 ± 15 | 135 ± 16 | 16 ± 2 |
| Burkina Faso | 550 ± 56 | 440 ± 30 | 546 ± 35 | 369 ± 15 | 37 ± 25 | 44 ± 30 | 7 ± 5 |
| Cameroon | 230 ± 3 | 595 ± 12 | 522 ± 41 | 412 ± 15 | 64 ± 22 | 77 ± 26 | 13 ± 5 |
| Chad | 234 ± 20 | 198 ± 6 | 527 ± 42 | 351 ± 10 | 11 ± 7 | 13 ± 9 | 2 ± 2 |
| China | 2,981 ± 62 | 1,976 ± 46 | 189 ± 19 | 547 ± 12 | 443 ± 17 | 461 ± 18 | 18 ± 2 |
| Colombia | 11 ± 1 | 966 ± 79 | 751 ± 48 | 325 ± 8 | 146 ± 37 | 162 ± 41 | 16 ± 4 |
| Cote d'Ivoire | 416 ± 20 | 406 ± 49 | 719 ± 71 | 271 ± 8 | 0 ± 0 | 0 ± 0 | 0 ± 1 |
| Egypt | 111 ± 12 | 730 ± 20 | 2 ± 1 | 669 ± 19 | 673 ± 19 | 779 ± 20 | 106 ± 2 |
| Ethiopia | 80 ± 6 | 671 ± 28 | 1,055 ± 72 | 307 ± 8 | 28 ± 13 | 33 ± 15 | 4 ± 2 |
| Greece | 244 ± 14 | 1,220 ± 81 | 206 ± 76 | 462 ± 14 | 361 ± 17 | 382 ± 18 | 20 ± 2 |
| India | 12,526 ± 328 | 441 ± 4 | 752 ± 36 | 375 ± 10 | 162 ± 15 | 189 ± 18 | 26 ± 3 |
| Indonesia | 1 ± 0 | 314 ± 31 | 325 ± 64 | 491 ± 12 | 302 ± 18 | 354 ± 20 | 52 ± 3 |
| Iran | 87 ± 5 | 819 ± 26 | 104 ± 21 | 624 ± 15 | 562 ± 30 | 652 ± 36 | 90 ± 6 |
| Kazakhstan | 115 ± 3 | 937 ± 7 | 120 ± 14 | 1,002 ± 39 | 922 ± 43 | 1,069 ± 50 | 147 ± 6 |
| Kenya | 10 ± 1 | 111 ± 19 | 561 ± 54 | 361 ± 7 | 124 ± 27 | 145 ± 32 | 21 ± 5 |
| Malawi | 15 ± 2 | 376 ± 21 | 546 ± 55 | 385 ± 13 | 131 ± 26 | 158 ± 31 | 26 ± 5 |
| Mali | 563 ± 102 | 362 ± 30 | 934 ± 36 | 370 ± 17 | 20 ± 9 | 24 ± 11 | 4 ± 2 |
| Mexico | 152 ± 12 | 1683 ± 49 | 178 ± 23 | 661 ± 17 | 565 ± 31 | 642 ± 36 | 77 ± 5 |
| Mozambique | 118 ± 13 | 260 ± 10 | 722 ± 72 | 291 ± 5 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Myanmar | 170 ± 7 | 649 ± 5 | 652 ± 39 | 355 ± 11 | 18 ± 12 | 21 ± 13 | 3 ± 2 |
| Nigeria | 455 ± 43 | 155 ± 6 | 396 ± 34 | 618 ± 32 | 178 ± 27 | 213 ± 32 | 36 ± 5 |
| Pakistan | 2,330 ± 210 | 602 ± 62 | 283 ± 28 | 667 ± 18 | 473 ± 55 | 563 ± 65 | 90 ± 10 |
| South Africa | 18 ± 1 | 886 ± 30 | 318 ± 16 | 505 ± 9 | 344 ± 30 | 365 ± 30 | 22 ± 3 |
| Spain | 54 ± 2 | 799 ± 126 | 77 ± 18 | 596 ± 9 | 554 ± 13 | 582 ± 13 | 28 ± 2 |
| Sudan | 288 ± 71 | 492 ± 75 | 309 ± 22 | 586 ± 44 | 512 ± 33 | 583 ± 40 | 71 ± 6 |
| Tanzania | 374 ± 36 | 166 ± 8 | 831 ± 82 | 412 ± 12 | 297 ± 46 | 339 ± 53 | 42 ± 7 |
| Togo | 84 ± 6 | 291 ± 11 | 857 ± 61 | 326 ± 7 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Turkiye | 464 ± 35 | 1,750 ± 58 | 66 ± 17 | 677 ± 16 | 624 ± 20 | 686 ± 21 | 63 ± 2 |
| Turkmenistan | 543 ± 15 | 373 ± 10 | 27 ± 6 | 878 ± 21 | 856 ± 25 | 986 ± 29 | 130 ± 4 |
| Uganda | 52 ± 8 | 305 ± 29 | 793 ± 78 | 362 ± 13 | 146 ± 28 | 0 ± 0 | 0 ± 0 |
| USA | 3,305 ± 262 | 960 ± 32 | 409 ± 24 | 508 ± 18 | 310 ± 36 | 283 ± 28 | 0 ± 2 |
| Uzbekistan | 1047 ± 7 | 638 ± 12 | 46 ± 9 | 780 ± 17 | 747 ± 22 | 833 ± 22 | 86 ± 2 |
| Zambia | 76 ± 19 | 244 ± 64 | 580 ± 76 | 333 ± 19 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Zimbabwe | 215 ± 13 | 217 ± 24 | 475 ± 72 | 377 ± 27 | 152 ± 44 | 0 ± 0 | 0 ± 0 |
| World | 31,216 ± 236 | 786 ± 8 | 533 ± 21 | 470 ± 6 | 373 ± 5 | 414 ± 6 | 41 ± 2 |

**Footnotes:**

- Irrigation Water Applied (mm/ha): 1 mm = 1 L per $m^2$ = 10,000 L per hectare
- Excess Irrigation (mm/ha): Excess irrigation water applied beyond crop requirements = Irrigation applied – crop water requirement
- World: Global averages calculated across all countries listed.

**Table-3** Cotton Water Footprint of Irrigation and Rainwater. Country-wise Data presented as Average Values of 5 years (2020-2024), with Standard Error of the Mean (Mean ± SE)

| | Water in Cotton Farms (Billion Liters) | | Water Footprint (L/Kg Lint). Mean ± SE | | | Water (Billion Liters) |
|---|---|---|---|---|---|---|
| Country | Irrigation Water Mean ± SE | Effective Rainfall Mean ± SE | Irrigation water $WF_{irri}$ | Rainwater $WF_{rain}$ | Total Water $WF_{total}$ | Withdrawal For Agriculture (FAO) |
| Argentina | 255 ± 35 | 2,450 ± 167 | 756 ± 61 | 7,255 ± 436 | 8,010 ± 465 | 27,863 |
| Australia | 1,579 ± 107 | 2,729 ± 494 | 303 ± 92 | 2,622 ± 276 | 2,925 ± 190 | 7,760 |
| Bangladesh | 0 ± 0 | 561 ± 77 | 0 ± 0 | 29,850 ± 8,187 | 29,850 ± 8,187 | 31,500 |
| Benin | 11 ± 1 | 3,807 ± 272 | 38 ± 3 | 13,555 ± 1,204 | 13,593 ± 1,202 | 33 |
| Brazil | 188 ± 24 | 9,856 ± 867 | 64 ± 7 | 3,372 ± 310 | 3,436 ± 303 | 41,270 |
| Burkina Faso | 2 ± 2 | 3,000 ± 330 | 9 ± 6 | 12,400 ± 1,433 | 12,409 ± 1,430 | 421 |
| Cameroon | 3 ± 1 | 1,202 ± 105 | 21 ± 7 | 8,772 ± 749 | 8,793 ± 747 | 737 |
| Chad | 0 ± 0 | 1,236 ± 139 | 1 ± 1 | 26,591 ± 22,96 | 26,592 ± 2,296 | 672 |
| China | 12,255 ± 497 | 5,645 ± 585 | 2,080 ± 84 | 958 ± 101 | 3,039 ± 67 | 353,279 |
| Colombia | 5 ± 1 | 85 ± 8 | 480 ± 128 | 7,772 ± 766 | 8,252 ± 826 | 25,442 |
| Cote d'Ivoire | 0 ± 0 | 2,992 ± 271 | 0 ± 0 | 17,728 ± 3,402 | 17,728 ± 3,402 | 600 |
| Egypt | 868 ± 104 | 2 ± 1 | 10,674 ± 508 | 30 ± 17 | 10,704 ± 521 | 61,350 |
| Ethiopia | 9 ± 4 | 840 ± 84 | 167 ± 75 | 15,733 ± 1,624 | 15,900 ± 1,591 | 9,687 |
| Greece | 897 ± 58 | 503 ± 157 | 3,012 ± 243 | 1,690 ± 884 | 4,702 ± 1,034 | 8,217 |
| India | 8,607 ± 1,051 | 94,149 ± 6,782 | 1,558 ± 170 | 17,043 ± 739 | 18,602 ± 852 | 585,388 |
| Indonesia | 2 ± 0 | 3 ± 0 | 5,650 ± 1,512 | 10,357 ± 3,320 | 16,007 ± 4,755 | 189,700 |
| Iran | 515 ± 38 | 91 ± 18 | 7,201 ± 457 | 1,271 ± 263 | 8,473 ± 427 | 85,677 |
| Kazakhstan | 1,114 ± 48 | 138 ± 19 | 10,318 ± 467 | 1,279 ± 151 | 11,596 ± 492 | 15,413 |
| Kenya | 1 ± 0 | 58 ± 9 | 533 ± 395 | 50,587 ± 13,906 | 51,120 ± 14,237 | 3,234 |
| Malawi | 1 ± 0 | 82 ± 17 | 187 ± 34 | 14,499 ± 1,910 | 14,685 ± 1,887 | 1,166 |
| Mali | 2 ± 1 | 5,260 ± 1,032 | 7 ± 3 | 25,836 ± 2,511 | 25,843 ± 2,509 | 5,075 |
| Mexico | 913 ± 84 | 270 ± 55 | 3,576 ± 283 | 1,056 ± 127 | 4,633 ± 291 | 68,069 |
| Mozambique | 0 ± 0 | 850 ± 97 | 0 ± 0 | 27,746 ± 3,112 | 27,746 ± 3,112 | 1,076 |
| Myanmar | 16 ± 9 | 1,106 ± 60 | 141 ± 93 | 10,057 ± 574 | 10,198 ± 525 | 29,428 |
| Nigeria | 13 ± 3 | 1,801 ± 168 | 179 ± 25 | 25,642 ± 3,112 | 25,821 ± 3,094 | 5,509 |
| Pakistan | 12,592 ± 2,369 | 6,602 ± 675 | 8,984 ± 1,105 | 4,710 ± 1,112 | 13,694 ± 1,687 | 248,277 |
| South Africa | 27 ± 2 | 58 ± 3 | 1,689 ± 111 | 3,590 ± 280 | 5,279 ± 236 | 19,075 |
| Spain | 262 ± 9 | 42 ± 12 | 6,043 ± 1936 | 967 ± 354 | 7,010 ± 2,229 | 17,796 |
| Sudan | 292 ± 70 | 891 ± 226 | 2,063 ± 598 | 6,291 ± 1,690 | 8,353 ± 1,669 | 17,598 |
| Tanzania | 0 ± 0 | 3,108 ± 451 | 1 ± 0 | 49,995 ± 5,909 | 49,996 ± 59,09 | 4,632 |
| Togo | 0 ± 0 | 717 ± 56 | 0 ± 0 | 29,509 ± 3,045 | 29,509 ± 3,045 | 76 |
| Turkiye | 2,992 ± 264 | 306 ± 80 | 3,683 ± 150 | 376 ± 106 | 4,059 ± 198 | 45,000 |
| Turkmenistan | 5,350 ± 291 | 146 ± 32 | 26,465 ± 906 | 724 ± 166 | 27,189 ± 775 | 24,342 |
| Uganda | 0 ± 0 | 415 ± 59 | 0 ± 0 | 26,048 ± 5,202 | 26,048 ± 5,202 | 259 |
| USA | 2,889 ± 215 | 13,535 ± 1,561 | 910 ± 92 | 4,265 ± 327 | 5,175 ± 274 | 176,242 |
| Uzbekistan | 6,904 ± 155 | 482 ± 100 | 10,334 ± 403 | 722 ± 138 | 11,056 ± 295 | 38,623 |
| Zambia | 0 ± 0 | 439 ± 87 | 0 ± 0 | 23,793 ± 5,948 | 23,793 ± 5,948 | 1,152 |
| Zimbabwe | 0 ± 0 | 1024 ± 158 | 0 ± 0 | 21,886 ± 5,477 | 21,886 ± 5,477 | 4,281 |
| World | 57,299 ± 1,109 | 166,484 ± 6,148 | 2,335 ± 32 | 6,785 ± 310 | 9,120 ± 301 | 2,155,920 |

**Footnotes:**

- Water Withdrawal Agriculture (FAO) (Billion Litres): 'Total water withdrawal' x '% of agricultural water withdrawal'
- World: Global averages calculated across all countries listed.

**Table-4** Distribution of Irrigation Technologies: Country-wise Data presented as Average Values of 5 years (2020-2024), with Standard Error of the Mean (Mean ± SE)

| | Irrigated Area | Lint Production | | % Distribution of Irrigation Technologies (Mean ± SE) | | | |
|---|---|---|---|---|---|---|---|
| Country | (1000 Ha) Mean ± SE | (1000 Tonnes) Mean ± SE | Irrigated Area % | Flood | Furrow | Sprinkler | Drip |
| Argentina | 92 ± 6 | 338 ± 23 | 18 | 31 ± 2 | 45 ± 1 | 20 ± 2 | 5 ± 1 |
| Australia | 398 ± 46 | 1,041 ± 118 | 83 | 8 ± 1 | 67 ± 1 | 18 ± 0 | 7 ± 1 |
| Bangladesh | 3 ± 1 | 19 ± 5 | 7 | 13 ± 2 | 87 ± 2 | 0 ± 0 | 0 ± 0 |
| Benin | 6 ± 0 | 281 ± 15 | 1 | 100 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Brazil | 139 ± 8 | 2,923 ± 232 | 9 | 15 ± 2 | 54 ± 1 | 26 ± 1 | 4 ± 1 |
| Burkina Faso | 5 ± 0 | 242 ± 32 | 1 | 100 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Cameroon | 4 ± 0 | 137 ± 4 | 2 | 100 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Chad | 0.30 ± 0.03 | 46 ± 3 | 0 | 100 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| China | 2,656 ± 42 | 5,891 ± 106 | 87 | 7 ± 0 | 22 ± 3 | 4 ± 1 | 67 ± 3 |
| Colombia | 3 ± 0 | 11 ± 1 | 25 | 0 ± 0 | 73 ± 2 | 27 ± 2 | 0 ± 0 |
| Cote d'Ivoire | 0.00 ± 0.00 | 169 ± 25 | 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Egypt | 111 ± 12 | 81 ± 9 | 100 | 62 ± 1 | 23 ± 1 | 12 ± 1 | 3 ± 1 |
| Ethiopia | 27 ± 2 | 53 ± 4 | 36 | 8 ± 1 | 90 ± 1 | 2 ± 0 | 0 ± 0 |
| Greece | 235 ± 13 | 298 ± 35 | 96 | 0 ± 0 | 38 ± 3 | 40 ± 1 | 23 ± 2 |
| India | 4,564 ± 151 | 5,524 ± 159 | 35 | 38 ± 2 | 52 ± 1 | 0 ± 0 | 10 ± 2 |
| Indonesia | 0.44 ± 0.04 | 0.28 ± 0.08 | 54 | 47 ± 1 | 53 ± 1 | 0 ± 0 | 0 ± 0 |
| Iran | 79 ± 4 | 71 ± 6 | 91 | 38 ± 2 | 56 ± 2 | 1 ± 1 | 6 ± 1 |
| Kazakhstan | 104 ± 3 | 108 ± 3 | 91 | 26 ± 1 | 73 ± 1 | 1 ± 0 | 0 ± 0 |
| Kenya | 0.42 ± 0.03 | 1 ± 0 | 4 | 38 ± 3 | 62 ± 3 | 0 ± 0 | 0 ± 0 |
| Malawi | 0.67 ± 0.11 | 6 ± 1 | 5 | 100 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Mali | 6 ± 1 | 204 ± 44 | 1 | 100 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Mexico | 142 ± 11 | 255 ± 24 | 94 | 8 ± 1 | 83 ± 1 | 9 ± 1 | 0 ± 0 |
| Mozambique | 0.00 ± 0.00 | 31 ± 4 | 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Myanmar | 75 ± 3 | 110 ± 5 | 44 | 0 ± 0 | 100 ± 0 | 0 ± 0 | 0 ± 0 |
| Nigeria | 6 ± 1 | 70 ± 8 | 1 | 100 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Pakistan | 2,237 ± 204 | 1,402 ± 181 | 96 | 84 ± 1 | 16 ± 1 | 0 ± 0 | 0 ± 0 |
| South Africa | 7 ± 0 | 16 ± 1 | 39 | 0 ± 0 | 47 ± 2 | 53 ± 2 | 0 ± 0 |
| Spain | 45 ± 2 | 43 ± 8 | 83 | 0 ± 0 | 34 ± 2 | 19 ± 0 | 47 ± 2 |
| Sudan | 50 ± 11 | 142 ± 44 | 30 | 15 ± 1 | 80 ± 1 | 5 ± 1 | 0 ± 0 |
| Tanzania | 0.03 ± 0.01 | 62 ± 5 | 0 | 0 ± 0 | 95 ± 1 | 5 ± 1 | 0 ± 0 |
| Togo | 0.00 ± 0.00 | 24 ± 2 | 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Turkiye | 436 ± 32 | 812 ± 59 | 95 | 6 ± 1 | 61 ± 2 | 20 ± 1 | 13 ± 1 |
| Turkmenistan | 543 ± 15 | 202 ± 8 | 100 | 7 ± 0 | 92 ± 0 | 0 ± 0 | 1 ± 0 |
| Uganda | 0.03 ± 0.00 | 16 ± 3 | 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| USA | 1021 ± 69 | 3,174 ± 189 | 30 | 0 ± 0 | 36 ± 1 | 57 ± 1 | 7 ± 1 |
| Uzbekistan | 828 ± 5 | 668 ± 16 | 79 | 0 ± 0 | 78 ± 3 | 0 ± 0 | 22 ± 3 |
| Zambia | 0.00 ± 0.00 | 18 ± 7 | 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| Zimbabwe | 1.55 ± 0.22 | 47 ± 6 | 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 | 0 ± 0 |
| World | 13,828 ± 113 | 24,538 ± 228 | 44 | 30 ± 1 | 43 ± 1 | 8 ± 0 | 19 ± 1 |

**Footnotes:**

- Irrigated Area (1000 Ha): Total cotton area under irrigation in thousand hectares.
- Irrigated Area (%): Percentage of total cotton area that is irrigated.
- Distribution of Irrigation Technologies: Percentage (%) of irrigated area using each irrigation method, such as Flood, Furrow, Sprinkler, Drip