



OPPORTUNITY #29

What if agriculture cut its dependence on water?

WATERLESS FARMS

Advances in nanotechnology enable the delivery of micronutrients and pesticides through spray coatings that boost yields, safely protecting agriculture from pests and reducing the need for excessive watering.



MEGATREND

Saving Ecosystems

TRENDS

AgriTech
Food—Water—Energy Nexus
Nanotechnology

SECTORS AFFECTED

Agriculture & Food
Materials & Biotechnology
Chemicals & Petrochemicals
Energy, Oil & Gas & Renewables
Health & Healthcare
Utilities

WHY IT MATTERS TODAY

Agricultural outputs will need to grow by around 70% by 2050⁵²⁵ to meet the food needs of a rising population that today stands at nearly 8 billion⁵²⁶ and is expected to reach 9.7 billion by 2050.⁵²⁷ In parallel, the demands of industry and commerce for water will increase from 25% to 40%, most of which is driven by agriculture due to its high level of water use.⁵²⁸

While it is responsible for approximately two-thirds of global greenhouse emissions,⁵²⁹ agriculture's future will also be affected by climate change due to temperature changes and shifts in precipitation and wind patterns which will lead to variations in crop yields.⁵³⁰ For example, maize crop yields are projected to decline by 24%, while wheat could see growth of some 17%.⁵³¹

Still in its early days in relation to agriculture, nanotechnology has already revolutionised drug delivery and improved treatment options for infectious⁵³² and non-infectious⁵³³ diseases, including HIV⁵³⁴ and COVID-19 (the Pfizer–BioNTech and Moderna vaccines both used lipid nanoparticles to carry mRNA into cells⁵³⁵). The global market for nanotechnology more generally is expected to grow at a compound annual growth rate (CAGR) of 36% between 2022 and 2030, from \$1.8 billion to almost \$34 billion.⁵³⁶

Agricultural outputs will need to grow by around

 **70%** 

by 2050 to meet the food needs of a **rising population** which is expected to reach

9.7 BILLION

by 2050

THE OPPORTUNITY

Agriculture accounts for nearly three-quarters of global water use.⁵³⁷ Associated agrifood systems yield 11 billion tonnes of food a year, employ 4 billion people and have an important role in poverty alleviation, food security and energy efficiency.⁵³⁸ More than 3 billion people live in agricultural areas with high water shortages.⁵³⁹

Applied through a spray, scalable nanotechnological solutions – including nano pesticides and nanofertilisers – can be used on both crops and soil to reduce the need for water.⁵⁴⁰ Nanoparticles are measured in billionths of a metre and can have practical applications in climate response, engineering, space, sciences and medicine.^{541, 542} Given their small size, solubility and chemical composition,⁵⁴³ synthetic nanoparticles (including inorganic carbon nanotubes; iron, silica, copper, gold and silver nanoparticles; and polymers and liposomes) can act as organic carriers, enhancing the efficiency of agricultural production.⁵⁴⁴

Nanotechnology can significantly reduce the need for water in agriculture. It can also reduce reliance on non-renewable sources of energy, manage irrigation and enhance soil quality.⁵⁴⁵

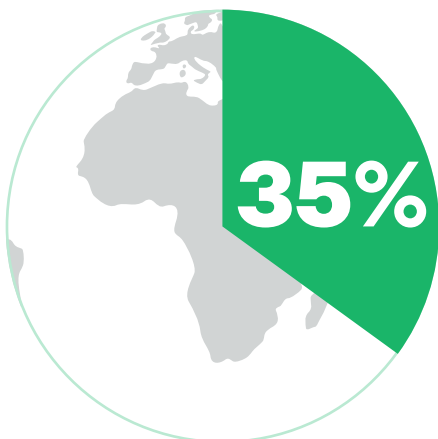
BENEFITS

Reduced need for water in agriculture. Avoidance of synthetic pesticides. Reduced waste.

RISKS

Health risks if nanotechnology (more generally) and coatings (more specifically) are not tested prior to use, particularly on food.

Over



of the world's population live in agricultural areas with **high water shortages**

