Gates Foundation

Gates Foundation's Garden of the Future Showcases Climate-smart Planting and Innovative New Toilet Technology at RHS Chelsea

This demonstration Show Garden highlights innovations that improve the health and livelihoods of smallholder farmers in the Global South and could now benefit growers in the UK.

Highlights

- The Garden of the Future at the 2025 RHS Chelsea Flower Show, supported by the Gates Foundation, spotlights the people and partnerships supporting communities in low- and middle-income countries to adapt and thrive in the face of a warming world
- The Show Garden, designed by award-winning garden designers Butler & Parker, is one of the only edible show gardens at RHS Chelsea
- The garden highlights climate-resilient crops like sweet potato, chickpea and pigeon pea; plus, other innovative solutions that are helping to secure healthy diets and stable livelihoods for those living in regions most impacted by changing and challenging weather conditions. These crops, developed by CGIAR, a global agri-research partnership and supported by the Gates Foundation, could become more commonly grown in the UK in the future as temperatures warm
- The garden also features an innovative new toilet technology with the Cranfield Circular Toilet, a compact and self-contained household toilet system. The innovation converts household-generated wastewater into clean, non-potable water for irrigation, and pathogen-free biochar for garden use.

The Garden of the Future highlights a range of climate-resilient crops and other innovations that are helping smallholder farmers in sub-Saharan Africa and South Asia to secure healthy, nutritious diets and stable livelihoods, despite the challenges of more extreme weather, periods of drought and sudden, heavy rainfall. The innovations in the Show Garden, the first-ever Gates Foundation-sponsored garden at RHS Chelsea, were developed with investments by the foundation in collaboration with global partners. This garden is designed by Butler & Parker.

Changing weather patterns are threatening the future for people everywhere, especially those who rely on the land to grow food and crops. In sub-Saharan Africa, most of the 1.2 billion population (about 15 percent of people, globally) work in agriculture, a sector that accounts for about 20 percent of the region's GDP. Harsher weather conditions have already reduced per capita GDP across the continent by 14 percent. And scientists warn that rising temperatures alone could cut yields of maize – one of Africa's most important food crops – by more than 20 percent. The result is less food to go around that's also less nutritious. These challenges are also increasingly being faced by communities in countries like the UK.

Enabling healthier, climate-resilient futures for smallholder farmers

Despite these huge challenges, there are many solutions being developed by scientists, innovators and growers, with support from the Gates Foundation. These include solutions that enable healthier, climate-resilient futures for smallholder farmers in sub-Saharan Africa and South Asia, who depend on them for their food, and for communities throughout the world.

This demonstration Show Garden showcases many of these solutions, including a wide array of climate-resilient ornamentals and vegetables, edible plants with multiple uses and properties and approaches that help conserve water and support sustainable planting. This includes climate-resilient vegetables that can grow and flourish in a wide range of environments (including here in the UK), innovative water harvesting and storage systems which support gardeners and farmers in times of unpredictable weather, as well as tools already helping growers globally but can also be applied in UK gardens.

With healthy soil, farmers can grow climate-resilient crops for a healthier future

In addition to focusing on the crops and plants themselves, the Garden of the Future highlights innovative solutions to promote water saving and safe reuse in the home or garden. One of those solutions is the Cranfield Circular Toilet, an innovative new toilet technology developed at Cranfield University in the UK, with support from the Gates Foundation, for global communities without access to safe sanitation. The Cranfield Circular Toilet is a compact non-sewered sanitation system that converts household generated wastewater into clean, non-potable water that can be used for garden irrigation, and pathogen-free biochar. A charcoal-like product produced from the toilet, the biochar can be used in the garden to help improve plant health by neutralising acidity and improving the retention of water and nutrients. With healthy soil, farmers can grow climate-resilient crops for a healthier future.

The people behind solutions

Celebrity chef Levi Roots will officially open the garden with a cooking demonstration using some of the edible crops from the no-dig vegetable patch, alongside two of the inspiring individuals who work to develop ground-breaking climate-smart growing techniques: Phoebe Mwangangi, a smallholder pigeon pea farmer from Makueni County, Kenya, who is leading her community in adapting climate-resilient growing techniques, and Dr. Clare Mukankusi, an agricultural scientist and Global Breeding Lead for the Common Bean at the Alliance of Bioversity International and the International Center for Tropical Agriculture in Kampala, Uganda, who focuses on developing new plant varieties that are more nutritious and easier to grow. Together they'll highlight how climate-resilient crops can provide nourishing options for communities around the world.

Quotes about the Garden of the Future:

Ana Maria Loboguerrero, Director of Adaptive and Equitable Food Systems at the Gates Foundation said: "The Gates Foundation works with partners globally and regionally to help people in Sub-Sahara Africa and South Asia who are disproportionately impacted by a changing climate. For these smallholder farmers and people who rely on the land for their livelihoods, this isn't an issue for the next generation – it's here now, and it's already affecting their economic and food security. By supporting farmers, scientists and innovators to develop and scale innovative farming solutions, we can help them and their families have more consistent food production and access to affordable, nutritious food all year long. The Garden of the

Future puts these innovators in the spotlight and shows what's possible when people work together, learn from each other and innovate to solve one of the world's biggest challenges."

Doulaye Kone, Director of Water, Sanitation and Hygiene at the Gates Foundation said: "Nearly half the world's population still lacks access to safe sanitation — a crisis that impacts health, education, and economic opportunity, especially for women and girls. A warming climate is compounding these challenges, making the need for innovative, water- efficient sanitation solutions more urgent than ever. Technologies like the UK-developed Cranfield Circular Toilet are helping us reimagine what's possible as we advance our goal to enable widespread use of safe, sustainable sanitation services to help drive positive health, economic, and gender equality outcomes for the world's poorest people."

Matt Butler and Josh Parker, Garden Designers at Butler & Parker said: "The Garden of the Future is a beautiful space that is practical and functional. Our goal is to take people on a journey of exploration and discovery, showcasing innovations, climate-resilient ornamentals and veg, edible plants with multiple uses and properties, and tools that demonstrate how growers, scientists, and communities are working together to grow a healthier future for everyone."

Dr. Ismahane Elouafi, Executive Managing Director, CGIAR said: "A warming climate, land degradation, and population growth are no longer future risks; they are realities smallholder farmers face every day, especially in the Global South. These farmers are on the frontlines of a global food crisis, and they need practical, science-based solutions they can use today. At CGIAR, we work directly with them, bringing climate-resilient crops, regenerative agriculture practices, and knowledge-sharing networks to the ground. We are supporting these farmers not only in adopting innovations but also taking a lead with them, allowing them to adapt to a changing climate while teaching others, transforming communities, and shaping food systems that can withstand the shocks to come. That's how real change happens—and that's why our work matters."

Phoebe Mwangangi, smallholder farmer from Makueni County partnering with CGIAR, Kenya said: "Climate change has affected our farming system because the rains are not reliable. Now we are working with CGIAR's climate-resilient crops and they are giving us a better yield. We are also using CGIAR agri-innovations like rainwater harvesting, minimal soil disturbance, timely planting, and management practices like mulching to retain the moisture. We are teaching the community, especially the women, that it is possible to farm and be food secure, despite the warming climate. It is very important that we empower women with these technologies because they can share this information faster with their neighbours. I'm optimistic because I've seen these same changes taking place in my community."

Levi Roots, celebrity chef and entrepreneur said: "I'm really excited to be involved in this inspirational initiative, shedding a light on sustainable farming and cooking which is close to my heart."

Garden Context and Features:

Our garden is set in the near future in the UK, in a scenario where weather patterns continue to change. The garden features climate-resilient crops that have been researched and developed by global agricultural innovation network CGIAR and other leading experts. In the garden, these crops are growing in test vegetable beds, demonstrating the no-dig gardening method, which can be used in gardens across the UK.

These crops include:

- **Millet** (Sorghum bicolor) - A drought-tolerant crop that is able to grow in poor quality soil, even rejuvenating the soil as it grows. Millet is a 'superfood' with great source of protein, fibre, iron, zinc and 10 times the calcium of wheat.

- **Pigeon Pea** (Cajanus cajan) - Due to its drought tolerance, pigeon pea is becoming a powerful grain legume crop for promoting food security across Africa, particularly in arid and semi-arid areas. This climate-resilient crop has been found to improve soil health by fixing nitrogen in the soil and produce quicker harvests for farmers.

- **Chickpea** (Cicer arietinum) - Chickpeas help with climate adaptation through improving soil fertility through boosting nitrogen in the soil and are more water-efficient than other crops. They are an important source of income, and a staple food for many smallholder farmers and their families.

- **Broad Bean** (Vicia faba) is also known as faba or fava bean and is a popular cool-season legume grown around the world. It can be eaten fresh or dried, fed to animals, and even turned into green manure to enrich soil. Current efforts to diversify the varieties of broad beans aim to strengthen its tolerance to heat, drought, and disease – making them a smart choice for a changing climate.

- **Common Bean** (Phaseolus vulgaris) - Common bean is a warm-season legume consumed worldwide for its edible seeds and pods. It is widely cultivated and represents one of the largest food components in Latin America and Africa.

- **Sweet Potato** (Ipomoea batatas) - New varieties of orange-fleshed sweet potatoes that are biofortified with vitamin A and able to withstand hotter, drier climates, have become a crucial resource for farmers and communities globally. More than 6.8 million households in Africa and South Asia are growing and eating these sweet potatoes. Consumed daily, they respond to children's vital nutritional needs and strengthen their immune systems.

- **Cowpea (**Vigna unguiculata) - Also known as black-eyed pea is a versatile legume and one of the longest cultivated crops on the continent of Africa, it provides nourishment for people and feed for livestock – a use that likely inspired its common name. Cowpea is fast growing and very flexible, often delivering multiple harvests and helping suppress weeds naturally.

Companion planting in the garden with varieties such as Purple Sage (Salvia officinalis Purpurascens) and Chamomile (Chamaemelum nobile) are used to highlight its benefits for plant health and biodiversity, as well as succession planting for productivity and yield with tasty produce including Khol Rabi, Chicory (Cichorium intybus 'Rossa Di Treviso') and Parsley. An edible boundary hedge provides foraging, plus habitats for wildlife, and areas of dappled shade with fallen log seating offers relaxation spaces for those working in the demonstration garden.

Climate-Smart Hub
A rammed-earth Climate-Smart Hub building features a semi-intensive biosolar green roof helping to insulate and capture carbon, with solar panels. Excess water from the green roof is

fed into a dipping tank. When this begins to overflow it then flows into a rainwater harvester which is pumped up using a solar powered pump from Futurepump, a British-Indian solar pump manufacturer, with a mission to deliver sustainable, reliable, and affordable irrigation.

Inside the Climate-Smart Hub
Inside the Hub, visitors will find out how smallholder farmers, scientists and gardeners are collaborating to create healthier futures both in the UK and globally. There are examples of innovations on display as well as informative case studies of the people and projects behind the inventions showcased in the garden.

These include:

Unearthing the Invisible: Using advanced X-ray and laser imaging, scientists at the University of Nottingham reveal detailed views of pigeon pea roots growing in both normal and high temperature soils to better understand how root systems respond to climate stress. This helps farmers breed more resilient and stronger crops. Visitors can explore 3D printed pigeon pea root models showcasing the different effects of heat stress on roots.

NatAlysis Project is a project led by CIMMYT, the University of Zimbabwe, and Rothamsted Research in the UK studying native maize varieties collected from farmers' fields. These are compared to hybrid and biofortified types to assess their nutritional value, especially key micronutrients like iron and zinc. Using faster, low-cost testing methods, the project helps identify nutritious, locally adapted maize options.

PlantwisePlus is a global programme from UK-based CABI that helps smallholder farmers grow more and earn more. Using easy-to-access digital tools, it gives farmers the trusted advice they need to protect their crops, use safer farming methods, and improve their harvests.

After the show, plants from the Garden of the Future will be relocated to the Energy Garden, an organisation helping community groups deliver gardens and solar projects in London, with a focus on transforming parts of railway stations and platforms into thriving gardens. The construction material from the Climate-Smart Hub will be broken down and used as a soil mulch/top dressing, and the green roof materials will be used to create smaller green roofs in the relocation sites. The Cranfield Circular Toilet will return to Cranfield University where it will be used in further R&D as they work on beginning household testing of this new technology.

ENDS

<u>Innovator Profiles:</u>

Phoebe Mwangangi
Pigeon Pea farmer and educator working with CGIAR
Makueni County, Kenya

Phoebe Mwangangi knows what it takes to grow something from nothing. Her small farm gets as little as 200mm of annual rainfall. Even the driest parts of the UK get three times that. Five years ago, Phoebe joined a CGIAR program to educate 10 neighbours on growing in a changing environment. She tried innovations like drought-resistant pigeon pea seeds and rainwater harvesting techniques, and the changes worked. She grew more food, with extra to sell for income. Curious neighbours began stopping by. Since then, Phoebe has helped train 500 farmers in the region.

Clare Mukankusi Mugisha, PhD
Global Breeding Lead with CGIAR's Research Center ABC (the Alliance of Biodiversity and the International Center for Tropical Agriculture)
Kampala, Uganda

Dr. Clare Mukankusi understands growers' concerns: unpredictable weather patterns mean low-yielding crops. And that means less food for the table, less income, fewer opportunities for their kids. But what if you could breed a better bean? A bean that grows with less water. One with more iron and zinc. One that you can cook more quickly, so you don't have to burn smoky fuel for hours. Fortunately, Clare found these answers in her lab, using conventional breeding methods to grow ever-better beans with all those special traits.

Ramatu Alhaji Yusuf
Community leader and farmer
Kano State, Nigeria

Women make up at least two-thirds of the farm workforce in Africa and Asia. These farmers need certain things to thrive, including better seeds, and leaders to guide them. Ramatu Alhaji Yusuf offers both.

Ramatu says her husband first taught her to farm. She quickly recognized cowpeas as an important nutritional crop. But the unpredictable climate was hurting everyone. Using improved seeds developed by a Nigerian agricultural research organization, IITA, she found she could harvest two crops of cowpeas in a single season. Now, she leads a local women's farming group as they share knowledge about seeds, timing, and techniques, and the collaboration is paying off. She's sent her children to better schools. Other women have bought land. Still others are opening new businesses. And their eyes, she said, have opened to new possibilities.

Chellapilla Bharadwaj, PhD
Principal Chickpea Breeder at the ICAR-Indian Agricultural Research Institute
Delhi, India

How do you feed a growing population with shrinking resources, smaller areas left to farm, and erratic or decreasing water supplies? Dr. Chellapilla Bharadwaj has an answer. More and better chickpeas!

Plant breeding is painstaking work. Sometimes, it takes a dozen years to get a new variety from lab to field. Now, new technologies are speeding up the process. Chellapilla's team studies these plants and uses conventional breeding techniques to identify desirable traits, like drought tolerance and disease resistance. His new climate-resistant chickpea has longer, fuller roots that hold moisture even in drought, providing 11 percent higher yield. That means more food to feed communities.

Rebecca Jerop, PhD
Agricultural Economist
Laikipia University, Kenya

Farmers in Kenya had shifted some years ago to non-traditional grains such as maize but productivity was only declining. Dr. Rebecca Jerop thought: could traditional grains turn things around?

She knew traditional grains such as Sorghum bicolor and millets sustained farm families in arid or semi-arid areas for generations. Yet they had been overlooked in modern research. For Rebecca, it was an opportunity. Through her research she found that finger millet could do well in unpredictable climates. Improved seeds could boost productivity. And interestingly, she found small farms got higher yields than large ones—a boon for small growers' income.

Key Facts:

- Warming temperatures are threatening the future for people everywhere, especially those who rely on the land to grow our food and crops. This includes smallholder farmers in sub-Saharan Africa and South Asia who are experiencing devastating floods, drought, shrinking growing seasons, and famine.
    - In sub-Saharan Africa, most of the region's 1.2 billion people (about 15 percent of the global population) work in agriculture.
    - Over the last 30 years, temperatures in African countries have risen faster than the global average.
    - Scientists warn that rising temperatures alone could cut yields of one of Africa's most important food crops, maize, by more than 20 percent.
    - The UN reports that climate change already has reduced per capita GDP across Africa by 14 percent, mainly due to its impact on agriculture, a sector that accounts for about 20 percent of GDP in much of the region.

These changes are also threatening global food security and nutrition in several ways.

- In the UK, climate analyses project that rising temperatures will increase the variability of weather, including the likelihood of extreme weather events like droughts and floods, resulting in significant risks to UK food security. In fact, projected temperature rises in Europe by 2035 could raise food inflation by 30 to 50 percent.
- Declining global crop productivity and higher food prices will impact overall calorie consumption as well as the nutritional quality of diets as people shift to cheaper, less nutrient-rich foods.
- In addition, rising CO2 is projected to reduce the nutritional value of key crops, reducing amounts of iron and zinc in daily diets.
- Poor nutrition is expected to cause the largest share of climate-related deaths, as nutrient gaps worsen people's health and make them more vulnerable to climate extremes (like heat waves or droughts).

Global food insecurity is contributing to child malnutrition.

- Today, one in four children under 5 years of age is surviving on one or two food groups a day, and on some days even less.
- Two-thirds of the world's children—more than 400 million—are not getting enough nutrients to grow and thrive.
- New analysis from the Gates foundation and IHME indicates that changing weather patterns will only worsen the burden of malnutrition - condemning an additional 40 million children to stunting and 28 million to wasting between 2024 and 2050.

Guided by the belief that every life has equal value, the Gates Foundation works to help all people lead healthy, productive lives. In developing countries, we work with partners to create impactful solutions so that people can take charge of their futures and achieve their full potential. In the United States, we aim to ensure that everyone—especially those with the fewest resources—has access to the opportunities needed to succeed in school and life. Based in Seattle, Washington, the foundation is led by CEO Mark Suzman, under the direction of Bill Gates and our governing board.

BUTLER & PARKER

GARDEN DESIGN

Butler & Parker is an award-winning design partnership with a decade of experience creating liveable gardens inspired by natural environments, produced with sustainability and the future in mind. Based in East London and Somerset, working on projects from London to the southwest, focusing on a range of small urban gardens and larger rural spaces. contact@butlerandparker.com | www.butlerandparker.com | Matthew Butler 07584 436136 Joshua Parker 07546 112813

CGIAR

CGIAR is a global research partnership for a food-secure future. Its science is dedicated to transforming food, land, and water systems in the face of a global agricultural crisis. CGIAR works through 13 global Research Centers and hundreds of partners to deliver innovative solutions that enable communities to produce enough food and improve lives sustainably. With a presence in more than 80 countries, CGIAR's work helps reduce poverty, enhance food and nutrition security, and improve natural resources and ecosystem services. CGIAR is led by Dr Ismahane Elouafi a 2025 TIME100 selectee.

Cranfield University

Cranfield University is a specialist postgraduate university with globally renowned expertise in science, technology, engineering and management. We deliver applied research that has real-world impact – 88% of our research is world-leading or internationally excellent (REF2021). Our innovative education is enhanced by large-scale facilities and global industry partnerships. Cranfield is one of the few universities in the world to have its own airport – our global research airport is a unique environment for research. We are a six-time winner of the prestigious Queen's Anniversary Prize, the highest national honour for educational institutions. Cranfield formed in 1946 as the College of Aeronautics, the first postgraduate college of its kind. The School of Management was founded in 1967.
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Garden of the Future Images for Media:

https://gatesfoundation.isebox.net/chelsea-flower-show-2025/chelsea-flower-show

Plant List with Common Names:

Alchemilla alpina - Alpine Lady's-mantle
Allium schoenoprasum - Chives
Angelica archangelica - Angelica
Arisaema tortuosum – Whipcord cobra lily
Berberis stenophylla
Berberis stenophylla Irwini or Hebe youngi - Golden Barberry
Beta vulgaris subsp. cicla var. Flavescens - Chard ‘Bright Lights’
Beta vulgaris subsp. cicla var. Flavescens - Chard 'Charlotte'
Briza media – Common quaking grass
Brunnera macrophylla Langtrees - Siberian bugloss 'Langtrees'
Buglossoides purpurocaerulea - Purple gromwell
Cajanus cajan - Pigeon pea
Calendula officinalis - Common marigold
Ceanothus thyr Repens - Creeping blue blossom
Centranthus ruber - Red valerian
Cephalaria gigantea - Giant scabious
Cerinthe major ‘Purpurascens’ - Honeywort 'Purpurascens'
Chamaemelum nobile - Common chamomile
Cichorium intybus 'Rossa Di Treviso’ - Radicchio 'Rossa di Treviso'
Cicer arietinum - Chickpea
Cistus purpureus - Purple-flowered rock rose
Corydalis flexuosa Craignton Blue - Corydalis 'Craigton Blue'
Corylus avellana - Hazel
Crataegus monogyna - Common hawthorn
Dicentra Baccharal - Bleeding heart 'Bacchanal'
Digitalis purpurea - Common foxglove
Digitalis purpurea alba - White-flowered foxglove

Digitalis purpurea 'Apricot Beauty' - Foxglove 'Sutton's Apricot'
Disporum Green Giant - Long-styled disporum 'Green Giant'
Disporum longistylum 'Night Heron' - Long-styled disporum 'Night Heron'
Dryopteris affinis - Scaly male fern
Dryopteris erythrosora - Copper shield fern
Epimedium omiense Akame - Barrenwort 'Akame'
Euphorbia myrsinites - Broad-leaved glaucous spurge
Fragaria vesca - Alpine strawberry
Geranium macrorrhizum White Ness - Big-root cranesbill 'White-Ness'
Geranium nodosum - Knotted cranesbill
Geranium phaeum Album - Dusky cranesbill 'Album'
Geranium sylvaticum Mayflower - Wood cranesbill 'Mayflower'
Gilenia trifoliata - Bowman's root
Helianthemum Rhodanthe carneum - Rock rose 'Rhodanthe Carneum'
Ipomoea batatas - Sweet potato
Iris germanica Craithie - Tall bearded iris 'Pink Charm'
Iris pallida pallida (dalmatica) - Dalmatian iris
Jasmine officinale - Common jasmine
Kohl Rabi F1 Ballot - Kohl Rabi
Lamium maculatum 'White Nancy' - Spotted deadnettle 'White Nancy'
Lamium orvala - Balm-leaved red deadnettle
Libertia grandiflora - New Zealand satin flower
Limnanthes douglasii Meringue - Poached Egg Plant
Linmonium latifolium - Broad-leaved statice
Lollo Rossa' Lettuce
Lunaria annua - Honesty
Luzula nivea - Snow rush
Maianthemum bifolium - May lily
Matteuccia struthiopteris - Shuttlecock fern
Nectoscordum (Allium) siculum - Sicilian honey garlic
Origanum vulgare (compactum) - Compact oregano
Parrotia persica - Persian ironwood
Parsley ‘Moss Curled' (Petroselenium) - Parsley ‘Moss Curled'
Phacelia tanacetifolia - Fiddleneck
Polystichum setiferum Herrenhausen - Soft shield fern 'Herrenhausen'
Rosa canina - Dog rose
Ribes uva-crispa ‘Capivator’ - Gooseberry 'Captivator'
Salvia officinalis Purpurascens - Purple sage
Santolina Lemon Queen (Edward Bowles) - Lavender cotton 'Lemon Queen'
Saruma henryi - Upright wild ginger
Sesleria autumnalis - Autumn moor-grass
Smyrnium perfoliatum - Perfoliate alexanders
Sorgastrum nutans - Indian grass
Sorghum bicolor - Great millet
Syneilesis aconitifolia - Shredded umbrella plant
Taxus - Yew
Tellima grandiflora Rubra - Fringe cups Rubra Group
Teucrium chamaedrys - Wall germander
Thalictrum Black Stockings - Meadow rue 'Black Stockings'
Umbilicus oppositifolius - Lamb's tail
Valeriana officinalis - Common valerian

Viburnum Opulus - Guelder rose
Viburnum tinus - Laurustinus 'French White'
Vicia faba - Broad bean
Vigna unguiculata - Cowpea
Viola sororia albiflora - Violet 'Albiflora'

Plants may be subject to change.