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1. How and why are plants grown in space: Takeaways from ISRO's success

Introduction



The lobia (black-eyed pea) seeds that the Indian Space Research Organisation (ISRO) sent to space on December 30 as a part of its Compact Research Module for Orbital Plant Studies (CROPS) germinated last week.

Why grow plants in space?

As humans venture out on lengthy space missions to colonise celestial bodies like

Mars and the Moon, space-grown plants can provide a sustainable food source. With minimal scope of restocking supplies, astronauts cannot simply rely on a limited stock of multivitamins during missions that may go on for years. Besides, pre-packaged vitamins break down and lose their nutritive value over long periods of time.

Since plants release oxygen during photosynthesis, growing them in space can help keep the air aboard spacecraft breathable. Plants can recycle carbon dioxide and organic waste, creating a closed-loop life support system. Tending to plants can also help reduce stress and improve astronauts' overall mental well-being, he said.

Why is it hard to grow plants in space?

The most significant challenge is microgravity, the condition in which people or objects appear to be weightless.

The lack of gravity precludes plants' roots from growing downwards, in addition to making nutrient delivery a difficult task. Since water tends to cling to any surface it touches in microgravity, when sprayed onto the base of a plant, it does not trickle down to the roots where it would be absorbed.

Plants grown in space also need to be protected from the high levels of radiation that can damage their DNA and hinder growth, and insulated from temperature fluctuations — often hundreds of degrees — that are normal in space, Pandey said.

Light conditions, especially in the outer Solar System where sunlight is scarce, pose another challenge. Without light, photosynthesis stops, and plants begin to consume more oxygen than they produce.

How are plants being grown in space?

Scientists have so far grown plants in space on a fairly small scale. The space garden aboard the International Space Station, known as 'Veggie' or the Vegetable Production System, is the size of the average carry-on bag. It typically holds six plants.

There are several ways in which plants can be grown in space. The most common is hydroponics. Water and nutrients in hydroponically grown plants are delivered via liquid solutions, rather than through the soil.

Plants can also be grown aeroponically, which eliminates the need for soil or any other medium. This method reduces water usage by 98%, fertiliser usage by 60%, and eliminates the need for pesticides altogether. "Plants grown in aeroponic systems have been shown to absorb more minerals and vitamins, making them healthier and potentially more nutritious," according to the US space agency NASA.

Plants can also be grown in space in soil-like media.

How did ISRO grow lobia in space?

The ISRO CROPS box is like a mini greenhouse. It has a soil-like medium, lobia, water, sunlight-mimicking lights, and Earth-like air. "The only thing different is gravity, at around 0.01 g", or 1% of the gravitational strength on the Earth's surface.

For the soil-like medium, ISRO used some highly porous clay comprising tiny pellets. The porosity helped absorb and retain water. The pellets consisted of a water-activated slow-release fertiliser, which was to provide nutrients to the plant in a controlled manner over a period of time.

For photosynthesis, ISRO used four warm LEDs and four cool LEDs. "The lights are programmed to be on for 16 hours and off for 8 hours, simulating day and night conditions... These durations can be changed based on various requirements," ISRO said in a statement.

Temperatures inside the module were regulated between 20 and 30 degrees Celsius, and Earth-like atmospheric conditions were maintained. Water was injected into the soil-like medium by an electric valve operated from Earth.

Seeds sprouted on the fourth day of the experiment, and the next day, two leaves were also visible.

What kind of plants are ideal for growing in space?

Plants are selected based on their growth rate, nutrient content, and compatibility with space farming systems.

Leafy green vegetables like lettuce, spinach, and kale, which grow quickly, require little space, and are rich in nutrients, are ideal space plants.

Beans and peas are also cultivated since they are protein-dense and can fix nitrogen in the soil-like medium, improving nutrient cycles.

“Radishes and carrots grow well in compact spaces... Wheat and rice are grown for long-term sustenance in space habitats,” Pandey said. Fruits such as tomatoes and strawberries can also be grown.

Relevance: GS Prelims & Mains Paper III; Science & Technology

Source: Indian Express

2. Third launchpad at Satish Dhawan Space Center: Why was Sriharikota chosen as India's spaceport?

Introduction

The infographic is a dark blue poster with white and yellow text. At the top left, it says 'Ministry of Information and Broadcasting, Government of India'. At the top right, it says 'CABINET DECISIONS 16th January, 2025'. The main headline is 'Cabinet approves Third Launch Pad at SDSC, Sriharikota'. Below this, there are three bullet points with icons: a hand holding a coin for 'Total fund requirement ₹3,984 crore+', a lightbulb for 'To be established within 4 years', and a rocket for 'To cater to a heavier class of ISRO's Next Generation Launch Vehicles'. At the bottom, it says '*Satish Dhawan Space Centre Indian Space Research Organisation'. The background features a large image of a rocket being mated to a launch pad structure.

The Union Cabinet recently approved the setting up of a third launchpad at the Satish Dhawan Space Center (SDSC) in Sriharikota — a spindle-shaped island on the east coast of Andhra Pradesh.

The new launchpad will help Indian Space Research Organisation (Isro) to become future ready to use the heavier Next Generation Launch Vehicle (NGLV) that it is currently developing.

The SDSC is the country's only spaceport from which spacecraft and satellites are launched. It became operational on October 9, 1971, with the flight of 'Rohini-

125', a small-sounding rocket, and was initially known as SHAR (Sriharikota Range). But in September 2002, the space centre was renamed Satish Dhawan Space Centre SHAR to honour mathematician and former Isro Chairman Satish Dhawan.

Why was Sriharikota chosen?

There were two primary reasons for selecting Sriharikota as the launch site. One, it is on the east coast which facilitates the launching of the rockets in an easterly direction. Two, its proximity to the equator.

“By launching a rocket eastwards, one can take advantage of Earth's rotation. For a launch site close to equator the magnitude of the velocity imparted due to Earth's rotation is about 450 m/s, which can lead to substantial increase in the payload for a given launch vehicle. Geostationary satellites must necessarily be in the equatorial plane. So, for such satellites, closer the launch site is to the equator the better it is,” the book mentioned.

There were other considerations also, such as it was a largely uninhabited area and closer to the sea. This helped ensure that the flight path of launch vehicles or rockets is entirely over the sea, so that impact of separated rocket hardware can take place on the high seas without any constraints, the book further added.

Who was Satish Dhawan?

Born in Srinagar, Dhawan was an Indian rocket scientist, known as the 'Father of Experimental Fluid Dynamics research' in India. He is also one of the foremost researchers in the field of turbulence and boundary layers.

In 1972, Dhawan succeeded Vikram Sarabhai as the Chairman of Isro. According to the space agency's website, "In the decade following his appointment, he directed the Indian space programme through a period of extraordinary growth and spectacular achievement... His efforts led to operational systems like INSAT- a telecommunications satellite, IRS – the Indian Remote Sensing satellite and the Polar Satellite Launch Vehicle (PSLV) that placed India in the league of space faring nations."

It was after his death in 2002 that the space centre in Sriharikota was renamed the Satish Dhawan Space Center to honour his legacy.

Relevance: GS Prelims; Science & Technology

Source: Indian Express

3. Global Economic Prospects (GEP) report

Introduction

India is set to dominate the global economic landscape, maintaining its status as the fastest-growing large economy for the next two fiscal years. The January 2025 edition of the World Bank's Global Economic Prospects (GEP) report projects India's economy to grow at a steady rate of 6.7% in both FY26 and FY27, significantly outpacing global and regional peers. At a time when global growth is expected to remain at 2.7 per cent in 2025-26, this remarkable performance underscores India's resilience and its growing significance in shaping the world's economic trajectory.

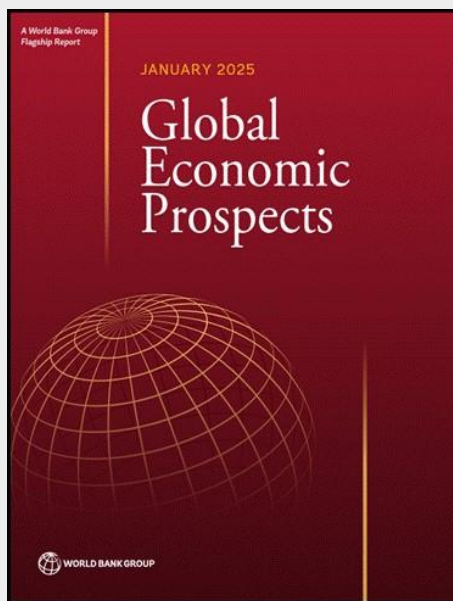
The GEP report credits this extraordinary momentum to a thriving services sector and a revitalised manufacturing base, driven by transformative government initiatives. From modernising infrastructure to simplifying taxes, these measures are fuelling domestic growth and positioning India as a cornerstone of global economic stability. With its closest competitor, China, decelerating to 4 per cent growth next year, India's rise is more than just a statistic. It is a powerful story of ambition, innovation, and unmatched potential.

Complementing the World Bank report, the latest update from the International Monetary Fund's (IMF) World Economic Outlook (WEO) also reinforces India's strong economic trajectory. The IMF forecasts India's growth to remain robust at 6.5% for both 2025 and 2026, aligning with earlier projections from October. This consistent growth outlook reflects India's stable economic fundamentals and its ability to maintain momentum despite global

uncertainties. The continued strength of India's economic performance, as projected by both the World Bank and IMF, underscores the country's resilience and highlights the sustained strength of its economic fundamentals, making India a crucial player in the global economic landscape.

Overview of World Bank's GEP Report

The Global Economic Prospects (GEP) report is a flagship publication of the World Bank Group that examines trends and projections in the global economy. It places a special emphasis on emerging markets and developing economies, offering insights into their growth trajectories and challenges. Published twice a year in January and June, the report serves as a vital resource for policymakers, economists, and researchers. The January edition delves into detailed analyses of pressing policy issues, while the June edition provides shorter, focused analytical pieces.

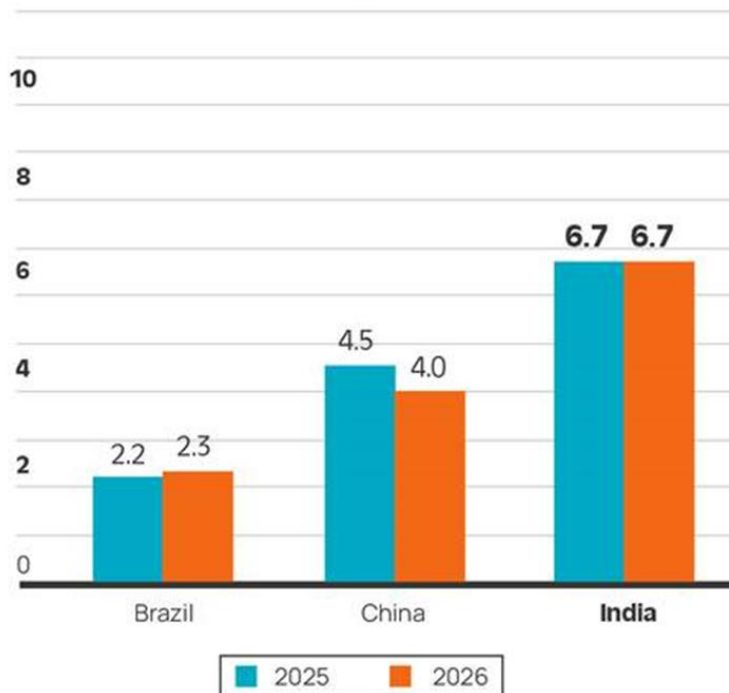


The latest GEP report marks a significant milestone by offering the first comprehensive review of the performance of developing economies since the beginning of the 21st century. With 2025 signalling the end of its first quarter, the report assesses the progress made by these economies since 2000 and evaluates their future prospects over the next 25 years. This edition features two analytical chapters. One examines the opportunities and challenges faced by middle-income emerging and developing economies, while the other focuses on the progress and hurdles of the world's poorest nations.

Key Findings in January 2025 Report

- India is projected to remain the fastest-growing large economy for FY26 and FY27, reaffirming its dominance in the global economic landscape.
- India's economy is expected to grow at a stable rate of 6.7 per cent annually during FY26 and FY27.

Top EMDEs Projected GDP Growth Rates



EMDE - Emerging Market and Developing Economies

**GDP growth rates for India are on a fiscal year (FY) basis, 2025 refers to 2025/26*

Source: World Bank

- Growth in India's services sector is expected to remain robust, while manufacturing activity will strengthen, supported by government efforts to improve logistics infrastructure and streamline tax systems.
- Private consumption in India is likely to gain momentum, driven by a stronger labour market, increased access to credit, and lower inflation.
- India's Investment growth is expected to remain steady, supported by rising private investments, improved corporate balance sheets, and favourable financing conditions.
- Global economic growth is projected to hold steady at 2.7 per cent in 2025-26, highlighting India's outperformance.
- Emerging Market and Developing Economies (EMDEs) have undergone significant transformation since 2000, now contributing about 45 per cent of global GDP, compared to 25 per cent at the start of the century.
- India, China, and Brazil, the three largest EMDEs, have collectively driven approximately 60 per cent of annual global growth since the start of the century.

Government Schemes and Initiatives Driving Growth

Government of India has implemented a series of visionary schemes and initiatives aimed at propelling the nation towards sustained economic growth and global leadership. From infrastructure development under the PM GatiShakti National Master Plan to fostering innovation through initiatives like Startup India and the Production Linked Incentive Scheme, these reforms are transforming sectors such as manufacturing, digital economy, and financial inclusion. Collectively, they reflect India's commitment to building a resilient, self-reliant, and globally competitive economy.

Conclusion

India's remarkable economic trajectory is a testament to its vision of inclusive growth and innovation-driven development. By implementing forward-thinking policies, fostering a robust infrastructure, and embracing digital transformation, the nation is redefining its global standing. As the fastest-growing large economy, with steady growth projected at 6.7% over the next two fiscal years, India continues to outpace global peers and cement its position as a leader in economic resilience and progress. From the Goods and Services Tax unifying the market to initiatives like Startup India and the Production Linked Incentive Scheme bolstering entrepreneurship and manufacturing, the nation is building a dynamic and robust economy. With this momentum, India is set to shape the future of the global economy, exemplifying the power of ambition, resilience, and strategic governance in achieving unparalleled progress.

Relevance: GS Prelims & Mains Paper III; Economics

Source: PIB