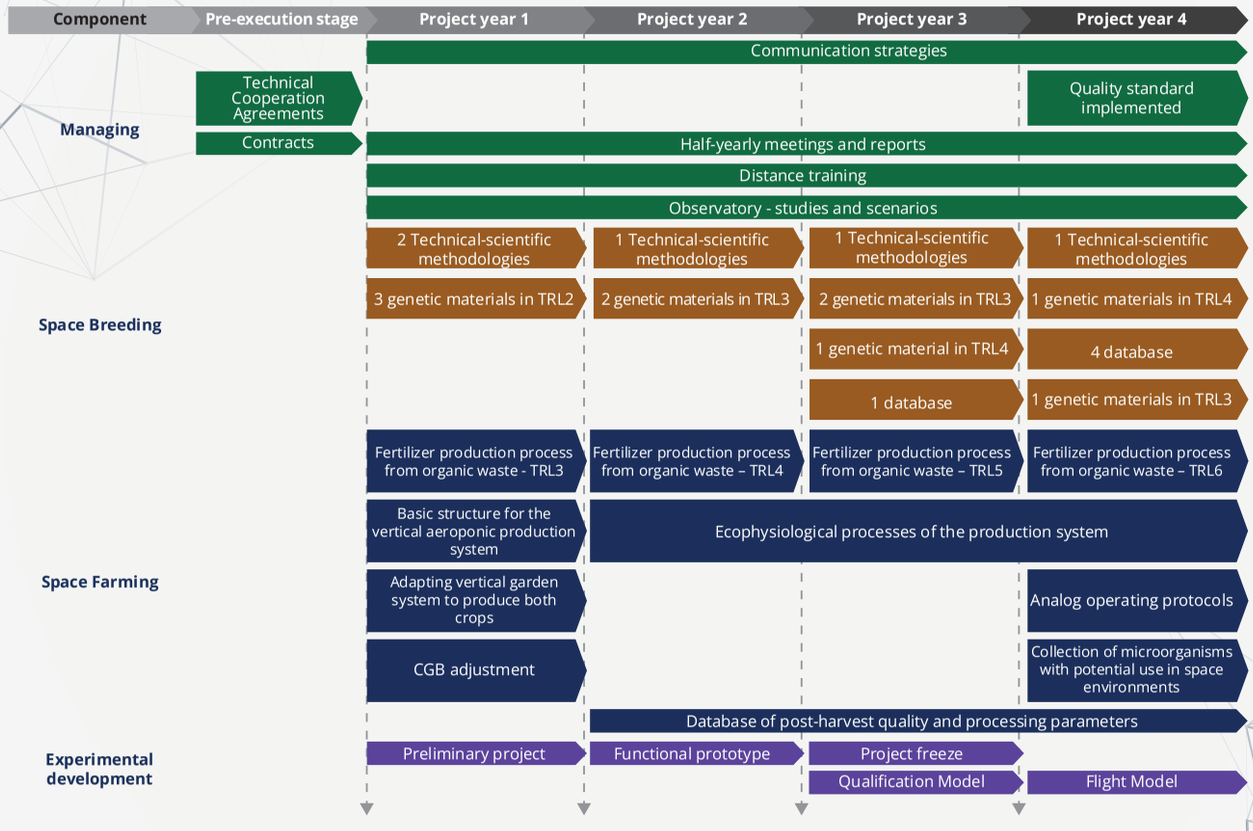
BRAZILIAN AGRICULTURE IN ARTEMIS PROGRAM

SPACE FARMING BRAZIL

PRODUCTS AND TECHNOLOGIES ROADMAP



ARTEMIS PROGRAM

The Artemis Program aims to carry out manned missions to the Moon and establish a permanent lunar base, serving as a springboard for future space station stays and trips to Mars. Foccusing on scientific advancement, technological innovation and collaborative exploration, the program invites the international community to join the Artemis Accords.

Brazil, through the Brazilian Space Agency and Embrapa, participates in this global effort, standing out in Space Agriculture research. This initiative seeks to adapt agricultural techniques to space conditions, contributing to the sustainability of missions.

Brazil's collaboration goes beyond space technologies, integrating various fields of knowledge. The country's excellence in areas such as agriculture, biotechnology and engineering will be crucial to the success of the Artemis missions. With this, Brazil is positioning itself as a strategic partner, committed to advancing space exploration and scientific innovation.

SPACE AGRICULTURE WORKSHOP

On March 14th and 15th, 2024, Embrapa hosted a workshop on Space Agriculture, bringing together 40 participants from 13 institutions. The Permanent Strategic Advisory Committee was established to strengthen Brazil's position in Space Agriculture research. The workshop allowed for detailed discussions on the indoor cultivation of sweet potato and chickpeas, focusing on water and energy efficiency, radiation tolerance, and technological suitability for space launches. The success of the event highlighted the participants' engagement, with plans for biannual workshops to monitor and adjust strategies. Coordinators were tasked with developing a roadmap of products and technologies, marking a significant step in Brazil's space agricultural innovation.

RESEARCH AREAS

- Influence of microgravity on living organisms
- Influence of space radiation on living organisms
- Development of crops resistant to the space environment
- Development of vertical farms and bioreactors
- Space technologies to overcome challenging conditions on Earth, such as in hostile, arid, or desert areas

From **September 23 to 25, 2025**, Brasília will host the **1st Brazilian Congress of Space Agriculture.**

Don't miss the opportunity to explore the future of agriculture beyond the Earth. For more details, visit the **AEB and Embrapa websites.**

SWEET POTATO AND CHICKPEA

In the first phase of the Artemis Program, **sweet potato and chickpea** were chosen as model plants due to their nutritional importance and antioxidant content. Assessing the adaptation of these plants to extraterrestrial environments on the Moon, Gateway, or Mars is essential for future space colonies. The research focuses on generating genetic variability and selecting plants **efficient in water and energy use, tolerant to ionizing radiation, and with high productivity and nutritional quality.**

The results of this phase will help adjust methodologies and test hypotheses about recreating extraterrestrial environments in the laboratory. This involves exposing plants to ionizing radiation and microgravity, and considering factors such as temperature range, artificial lighting, and soilless cultivation (aeroponics). The search for self-sustaining production systems includes developing technologies to create fertilizers from waste and finding alternative sources of water and energy. These efforts aim to adapt crops to adverse conditions on Earth, such as climate change and vertical farms in urban or desert areas, **in order to increase our food security in a scenario of climate change and extreme weather.**

Areas of study include:

- Genetic improvement of chickpea
- Genetic improvement of sweet potato
- Physiological responses of plants under challenging conditions
- Chromosome duplication to increase grain size and tolerance to
- ionizing radiation
- Analysis of the effects of radiation on the chromosomes of these plants

The potential impact of this research is vast and could **create innovative technologies** that transform both **space exploration and terrestrial agriculture.** Brazil, through Embrapa and AEB, is at the forefront of this movement, making a significant contribution to space agriculture and future sustainability.