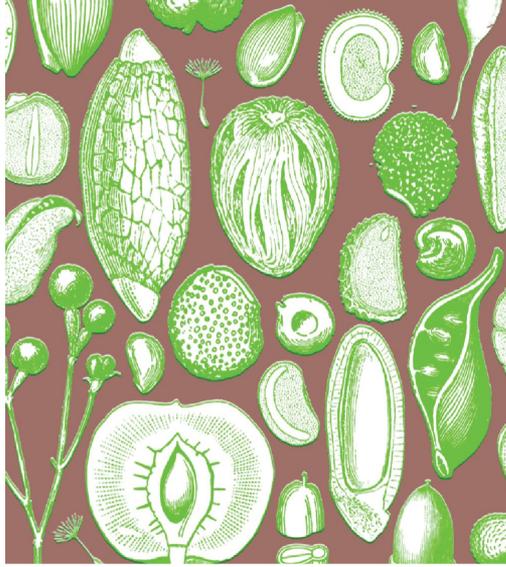
A rocket launch in space against a dark blue background. The rocket is angled upwards from the bottom right towards the top left, leaving a bright, glowing trail of fire and smoke behind it. The text is overlaid on this scene.

Satellite Seed Savers

A project of the Space Permaculture research initiative



SUMMARY

Satellite Seed Savers is a network of gardeners who grow, interpret, and preserve the seeds of edible plants that have been cultivated or eaten in outer space. It is a part of the *Space Permaculture* research initiative.

Genomic Gastronomy
2023-2024



SUMMARY

Satellite Seed Saver gardens are sites for assembling and distributing off-planet agricultural biodiversity. They aim to direct the visitors' gaze upwards* —and connect the plants in the garden to multi-species activities in the sky—asking questions about environmental stewardship in outer space and here on Earth.

There are many local and national seed saving programs that preserve the historical agricultural biodiversity of a place, but who will assemble, maintain and propagate plant varieties that have been grown in, or cultivated for, outer space?

*Drawing on the 1635 CE Chinese garden manual *Yuanye* (園冶) this project utilizes the category of *yangjie* (仰借 "upward borrowing", clouds, stars) to direct the audiences gaze upwards.



SUMMARY

During the 2023 growing season, Genomic Gastronomy will begin working with gardeners and researchers around the world to grow, taste, debate and preserve the agricultural biodiversity of outer space.

Visit our reading room and seed library throughout the year and join the conversation:

#SpacePermaculture

#SatelliteSeedSavers



GARDEN SITES

We are working with gardeners, communities and individuals who want to grow a few plants in plots, pots, or home gardens.

POTENTIAL GARDEN SITES

Kilkenny, **Ireland** (Butler Gallery)

Santa Cruz, **USA** (UCSC)

Cesis, **Latvia**

Amsterdam, **NL**

Porto, **PT**

Beijing, **China**

Bengaluru, **India**



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EVENTS & ACTIVATIONS

Throughout the growing season (Mar-Oct 2023) the artists will engage participating satellite seed savers and gardeners all over the planet via live and hybrid events and activations.

Site Visit (March 8)

Visit to site & community garden community with NCAD, Dublin, IE.

Satellite Seed Savers: Seed Exchange

(March 11)

Seed distribution, reading room & discussions at Butler Gallery in Kilkenny, IE.

Harvest & Seed Saving (July)

Harvesting and Seed saving at Butler Gallery in Kilkenny, IE

Space Salad & Space Seed Savers (July)

Workshop to re-enact the first salad grown and eaten on the International Space Station, and become space seed savers in Cesis, Latvia.

ISS Spotting (August)

Looking up at the night sky and listening / learning about what/is growing on the International Space Station.

Global Video Conference (August)

A global video conference of Satellite Seed Savers around the world (date TBC).

—

Everyone can garden, not everyone can travel to outer space.



ARTIFACTS & MANIFESTATIONS

Throughout the project a series of objects, activations and media will be used to share research, generate discourse and cultivate meaning.

AUDIENCE: This project is intended to engage general and expert audiences with themes of agricultural biodiversity, environmental stewardship, long term thinking, earth systems and space science.

EXAMPLES

READING ROOM

Containing books such as *Co-Evolution Quarterly*, *One Straw Revolution*, etc.

FOOD PHREAKING

A new issue of our ongoing journal

NEWSLETTER

A (print or digital)

VENDING SEED VENDING MACHINE

For dispersing seeds that have been saved

BOOK

“SPACE PERMACULTURE: What we learned while preserving vegetable seeds for & from Outerspace.”

KIT

A Satellite Seed Saving Kit: including instructions, tools, tips...

INSTALLATION

With artifacts including Mars analogue soil and hydroponic growing systems.



EXAMPLE PLANTS

We are collecting the names, seeds and stories of various plants grown in or for outer space.

RICE

[*Danish expert doubts China's 'space rice'...*](#)

OUTREDEGEIOUS LETTUCE

[*Meals Ready to Eat...*](#)

POTATOES

[*In Peruvian "Mars" soil*](#)

ZUCCHINI, BROCCOLI, SUNFLOWER

[*Don Pettit Blog*](#)

ZINNIA

[*Scott Kelly*](#)

RUSSIAN LETTUCE, SUNFLOWERS, MORE

[*ISS, First experiments, history*](#)

MIZUNA GREENS

[*On ISS*](#)

SPACE SWEET POTATOES

[*on Space Shuttle Columbia*](#)

HANGJIAO 3 - SOLAR FLARE - SPACE PEPPER

[*Mutated Peppers*](#)

SOIL

[*Peruvian "Mars" soil*](#)

WINE

[*Decanter*](#)

GROWING MECHANISMS

[*Seed Film, Cutting Edge Space Garden*](#)

Tokyo Bekana

[*Chinese Cabbage*](#)



Seeds - Round 1

OUTREGEOUS LETTUCE

Lactuca sativa

NASA selected Outredgeous Lettuce to be the first grown and eaten by their astronauts in space due to low microbial growth on the lettuce leaf surface.

Outredgeous was first grown in space in 2014, then flown back down to Earth for testing. A second batch was grown in 2015 and finally consumed by the astronauts. It was first grown in pillows using the Veggie grow system, and more recently was grown in newer film technology.

[NASA >>>](#)
[About the Breeder \(BBC\) >>>](#)
[Seed Film 2021>>>](#)

BREEDER

Frank Morton, 1998 at Wild Garden Seeds, Oregon >>>

CHARACTERISTICS

Large, upright, loose-leaf [cos type](#) head. Good for 'cut and come again'.

Very red color.

Hardy over winter.

Good for spring sowing.

Open Source Seed Initiative variety

Sweet, crisp

GROWING INFO

50-55 days.

4-8 hours of Sun

Sprouts in 7-10 Days

Ideal Temperature: 60-80 Degrees F

Seed Depth: 1/4"

Plant Spacing: 8"

Frost Hardy: Yes

Sow in thick bands for baby greens or space farther apart for head lettuce.

Best grown as a spring or fall crop in most areas.

[Seed Saving>>>](#)

SUPPLIERS

[Rare Seeds](#)

[Johnny's](#)

[Irish Seed Savers](#)

SPACE SIGNIFICANCE

First lettuce grown and eaten by NASA astronauts in space.



HANGJIAO 3

SOLAR FLARE SPACE PEPPER

Capsicum annuum

In 1987, a chinese space project was developed to send seeds into orbit on satellites in order to induce mutations.

Scientist Jiang Xingcun of the Chinese Academy of Sciences had discovered that exposing seeds to zero gravity, magnetic fields, and high energy cosmic radiation in space made mutations (including changes to fruit size, yield, and nutritional value) much more likely. The project aimed to contribute to food production in China in order to keep up with growing demand. China has sent more than 400 species of seed to space including 10 varieties of Hangjiao Space Chilis.

[Video of Tasting >>>](#)

[Collection >>>](#)

[Chinese space mutation program>>>](#)

BREEDER

Jiang Xingcun, 1987 at Chinese Academy of Sciences

CHARACTERISTICS

~58 to 100 days to mature.

~2 cm wide and 20 cm long peppers

Curly and straight peppers

Ripens from green to bright orange.

Medium heat 5000 - 10 000 SHU

Hottest from the Hangjiao Project.

Good for cooking.

Good for drying (and they become hotter)

Juicy flesh with a slightly sweet taste.

GROWING INFO >>>MORE>>>

Peppers require a long warm season to produce fruits, taking from 58 to 100 days to mature. Start seeds six to eight weeks before you plan to plant them outside. Use seed starting mix.

Spread the pepper seeds across the soil. Cover them with a light layer of the soil about twice as thick as the seed width.

Mist the planted container with room temperature water until the starting mix feels damp all the way through. Cover the tray or pots with a humidity dome or plastic film. Place the planters in a warm location (70 - 80 F) to germinate. Check the peppers daily for moisture levels and seedlings.

Germination takes 7 to 14 days. Remove the plastic cover when seedlings appear. [Seed Saving>>>](#)

SUPPLIERS

[Hippy Seed Company](#)

[Vertiloom](#)

SPACE SIGNIFICANCE

Chinese space project.



MIZUNA

Brassica rapa var. japonica

Mizuna mustard greens were grown on the ISS in 2019 in order to demonstrate the potential of space agriculture, test the result of various growing lights and conditions in the VEGGIE system (VEG-04 study), and provide fresh greens for astronauts to eat.

Mizuna was also used as a “countermeasure” which aims to alleviate the psychological stresses associated with spaceflight. It’s notable that the overall sustainability of growing in space for longer periods is still unclear.

[VEG-04 Study>>>](#)

[NASA1>>>](#)

[NASA2>>>](#)

BREEDER

Cultivated for centuries in the mountainous region of Kyoto, Japan.

CHARACTERISTICS

*Cool-season green
Mild mustard flavor
Thin stalks
Very serrated leaves*

GROWING INFO

*~40 days or baby greens can be harvested sooner.
Sow outdoors from early spring to late summer
Succession sow every 2-4 weeks.
Sow 1/4 inch deep in spring (1/2 inch deep in summer to keep seeds cooler).
Ideal germination temp is 75 (but 45-80F is OK)
Sow seeds 1 inch apart in rows 18 inches apart.
Thin to 6 inches apart.
Seeds germinate in 4-7 days.
Full sun to part shade.
Loose, well-drained soil.
Less susceptible to brassica pests and diseases than its other brassica relatives.
[Saving Seed >>>](#)*

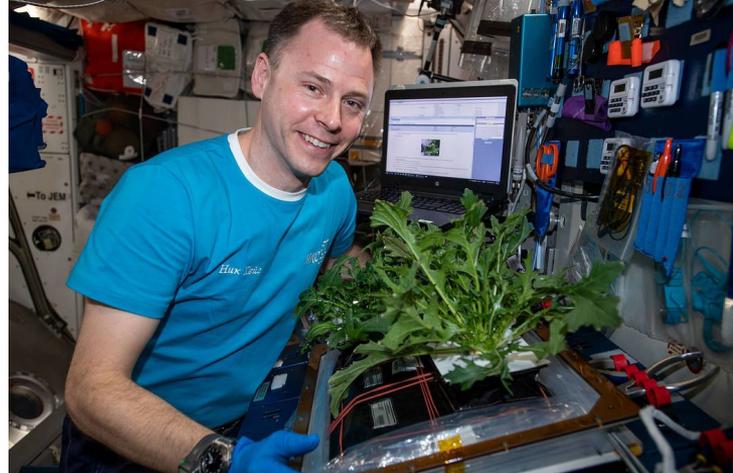
SUPPLIERS

[Irish Seed Savers](#)

[Rare Seeds](#)

SPACE SIGNIFICANCE

Grown for testing and eating in space 2019



TOKYO BEKANA

Brassica rapa var. chinensis

Tokyo Bekana (aka “Space Cabbage”) was trialed and grown on the ISS in 2017 as part of the Veg-03 experiment.

Tokyo Bekana is a fast-growing and nutritious variety which can also be harvested at any stage of growth, making it a very practical choice. However, it was only selected for the experiment after a taste-test by Johnson Space Center’s Space Food Systems team’s volunteer tasters. Tokyo Bekana out-scored the other contenders in flavor.

[NASA>>>](#)

[Various Information>>>](#)

BREEDER

Bred in Japan from Chinese cabbages introduced in the 20th century by soldiers returning from the Russo-Japanese war.

CHARACTERISTICS

Loose-headed, lightweight cabbage

Crisp and tender

Mild, sweet, and spinach-like with mild pepper flavor

Slightly crinkly leaves.

Cut-and-come-again young leaves for salads.

Larger leaves are good for cooking

GROWING INFO

Sow indoor before March

Sow outdoor in March-Oct

Seed spacing between the row: 15-20 cm

Seed spacing in the row: 10-15 cm

Sowing depth: 1-2 cm

[Seed Saving >>>](#)

SUPPLIERS

[Satvia](#)

[Hudson Valley Seed](#)

SPACE SIGNIFICANCE

Grown in the Veg-03 Experiment on the ISS in 2017



END