



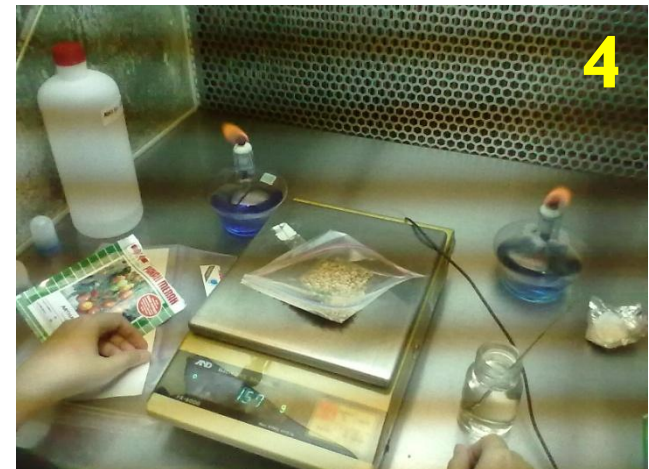
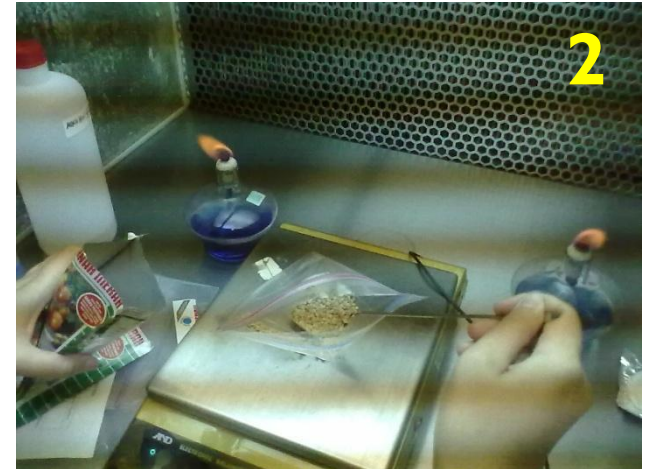
SPACE SEEDS-RELATED ACTIVITY IN INDONESIA (2010 – 2012)

SPACE SEEDS FOR ASIAN FUTURE



Tomato Seeds (*Solanum Lycopersicum*) Journey to Japan and from Japan

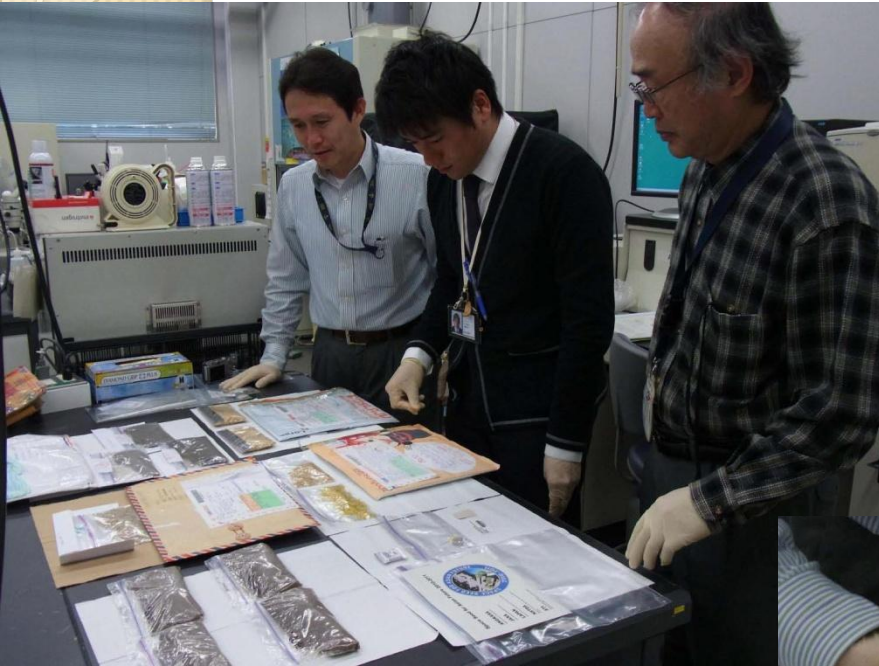
Tomato seeds were transferred from the commercial package into JAXA standard package



Sealed and signed tomato seeds package was ready to send to Japan

The double ziplock package was signed and sealed with 3M double tape





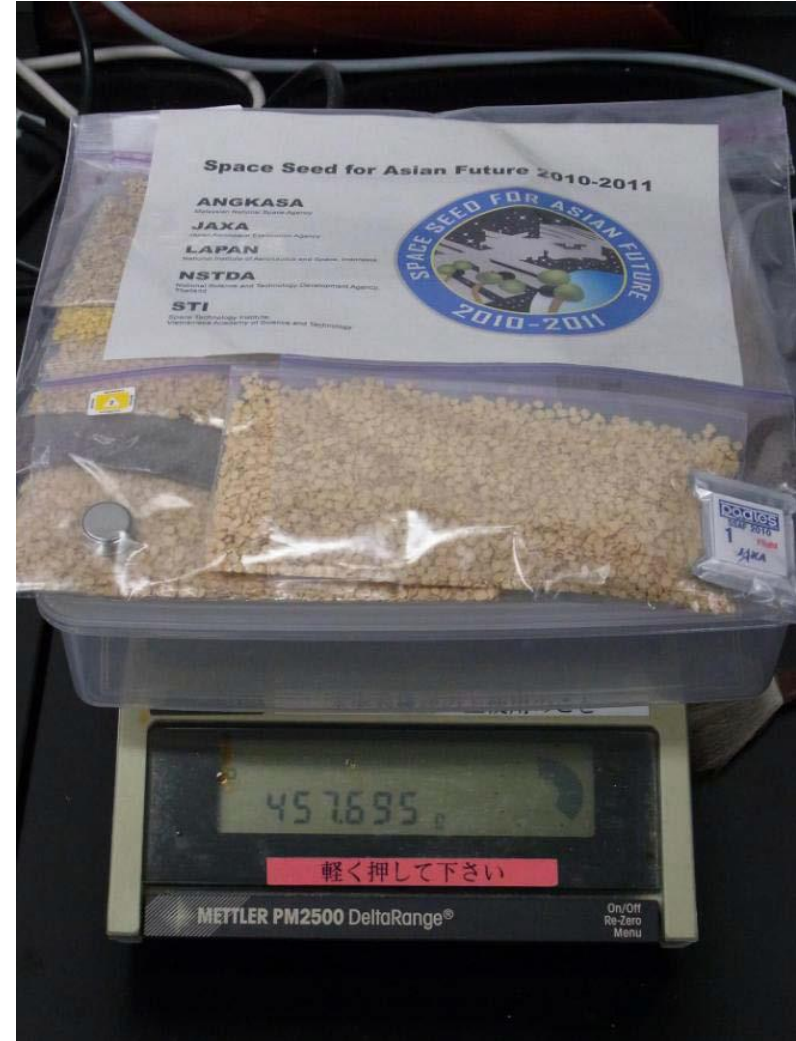
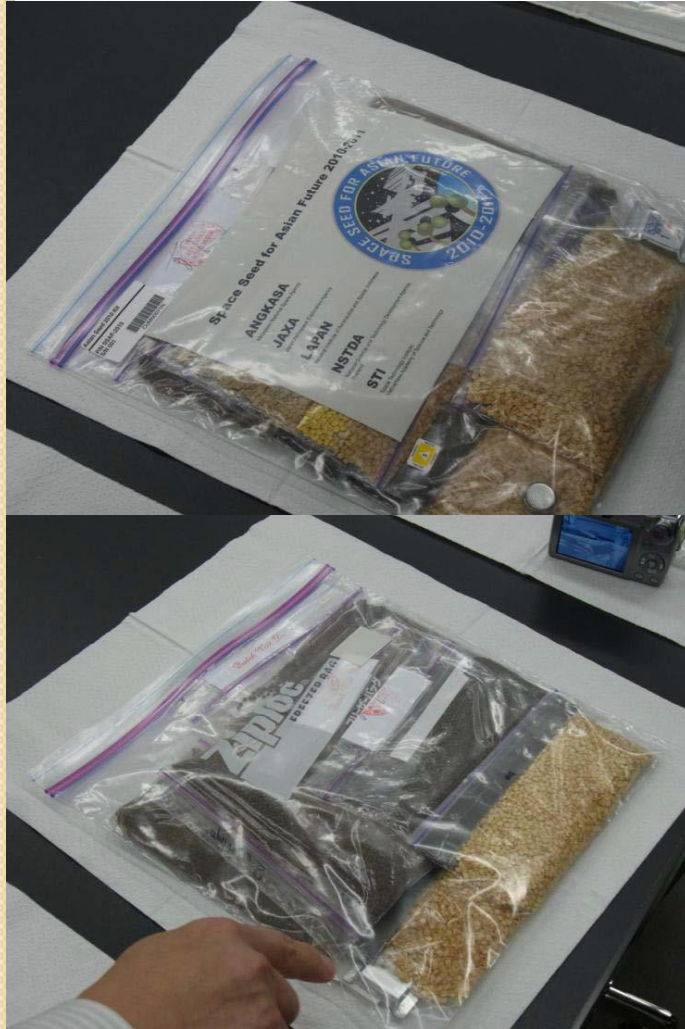
The seed is inspected
and prepared to the
flight



Credit: Yoichi Hasegawa



Flight Package (JAXA)

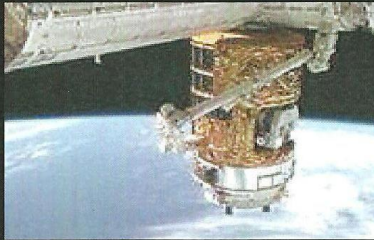


Credit: Yoichi Hasegawa

SSAF 2010-2011 Mission



HTV2(konotori)



HTV2 is captured
by SSRMS

Internal HTV



H-2B Lift off
Jan.22, 2011



Seeds in ISS "Kibo"
Module

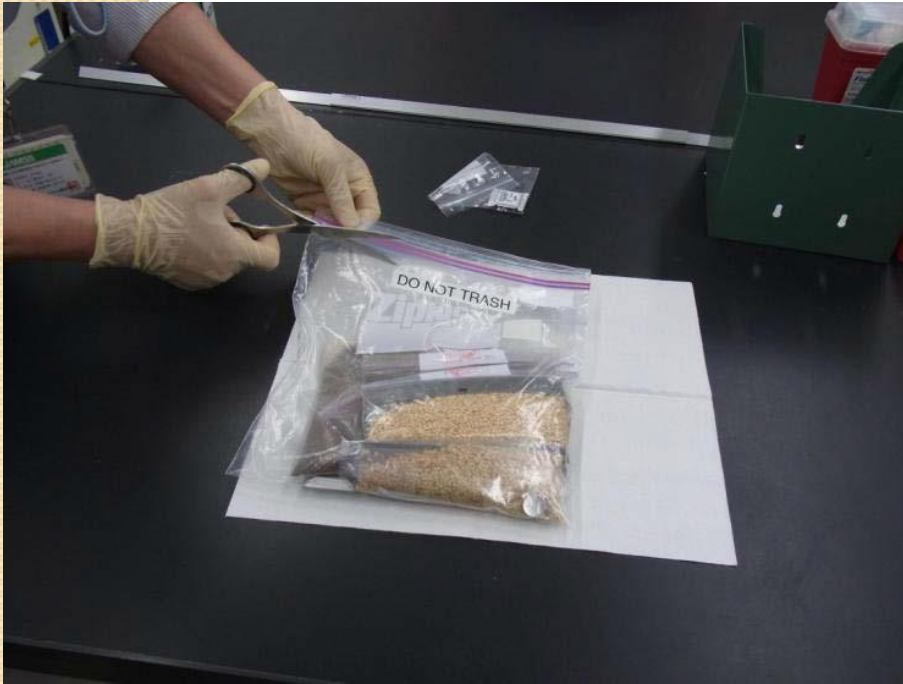
180 Days
Mission



Recovery June 1, 2011

Credit: Muneo Takaoki

Returned from Space



Shipped to Indonesia



Credit: Yoichi Hasegawa

The tomato seeds back from Japan





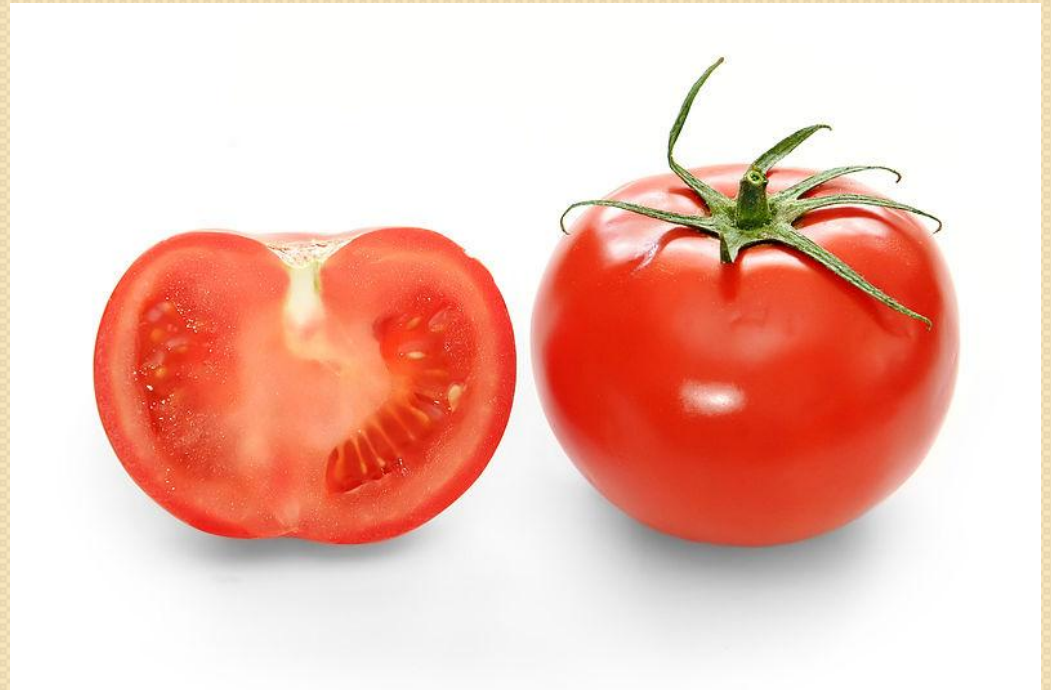
SPACE SCIENCE FESTIVAL
OCTOBER 2011

Commemoration of



World Space Week

World Space Week 2011



Tomato Seeds
Solanum Lycopersicum

Space Seeds for Asian Future

Space Science Festival

- October 29, 2011
- LAPAN Bandung
- Collaboration of LAPAN, JAXA, ITB
- Attended by students (elementary, high school)
- Activities:
 - Public lecture (ISS/Dr. Muneo Takaoki, SSAF/Mr. Yoichi Hasegawa)
 - Presentation from LAPAN (Ms. Nur Laela Sari) and ITB (Dr. Rizkita)
 - Competition of space seeds project
 - coloring and drawing competition
 - astrogame for kids
 - exhibition

Lectures



Presentation from JAXA (Dr. Takaoki and Mr. Hasegawa)
ISS and SSFAF



Presentation from ITB (Dr. Rizkita)
The Effect of Space Environment on Plant Seed



Presentation from LAPAN
(Ms. Nur Laela Sari)
LAPAN's involvement in SSAF 2010-2011

'Space' Coloring and Drawing Competition



'Space' Coloring Competition:
grade 1- 3 Elementary School
'Space' Drawing Competition:
grade 4 – 6 Elementary School

Winners of Drawing Competition



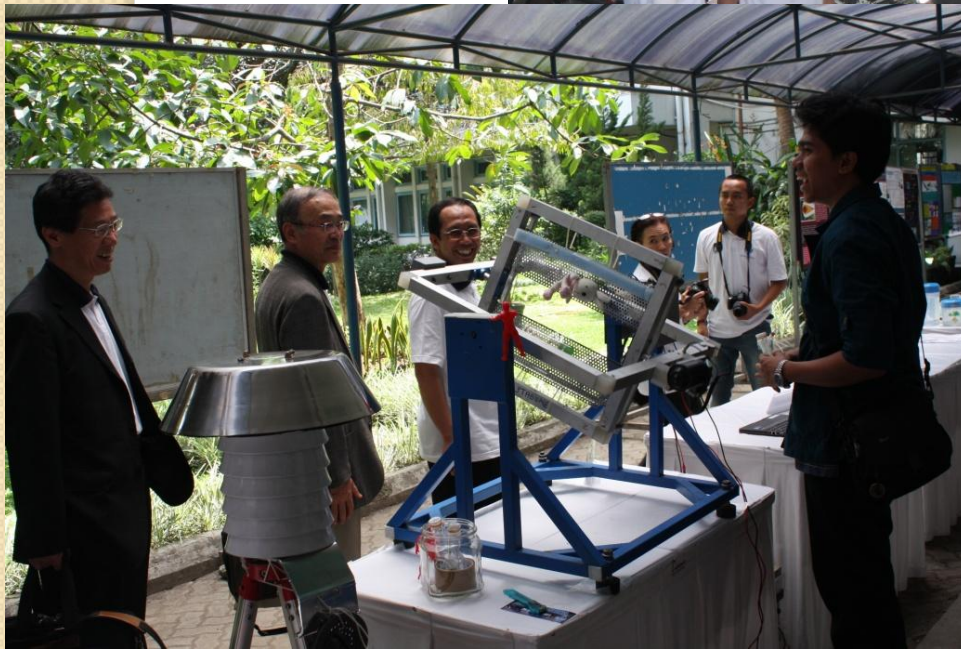
Winners of Coloring Competition



Exhibition




Astrogame for kids
(ladder and snake)



Clinostat



Seeds Distribution to Students



ITB prepared the space seeds, as well as clinostat treated seeds and control ones to be distributed.

Space tomato seeds distributed to secondary school students.

They planted, observed, and reported.

Tomato Seeds Sterilization



Seeds from ISS



Rinse in
sterilized
water



Seeds from ground control
and clinostat control



Tomato Seeds Sterilization

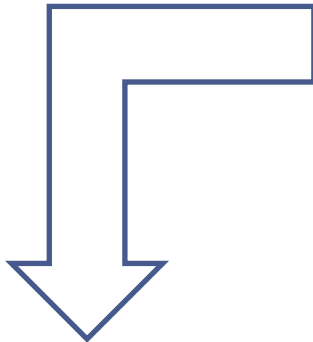


Spill out
the water



Rinse in
Clorox
15%

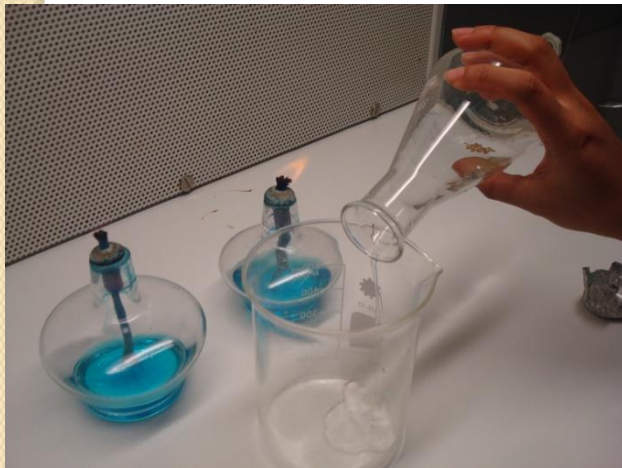
Spill out the
clorox



Tomato Seeds Sterilization



Rinse in
sterilized
water

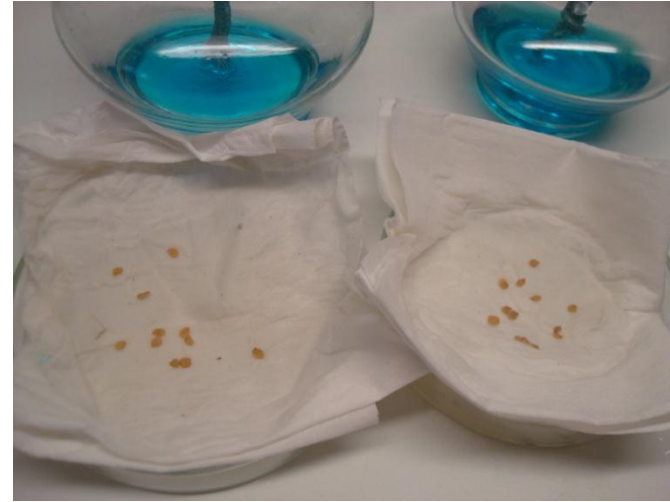


Spill out
the water



This step was repeated several times to ensure no clorox remains on the seed coat

Seeds Redehydration

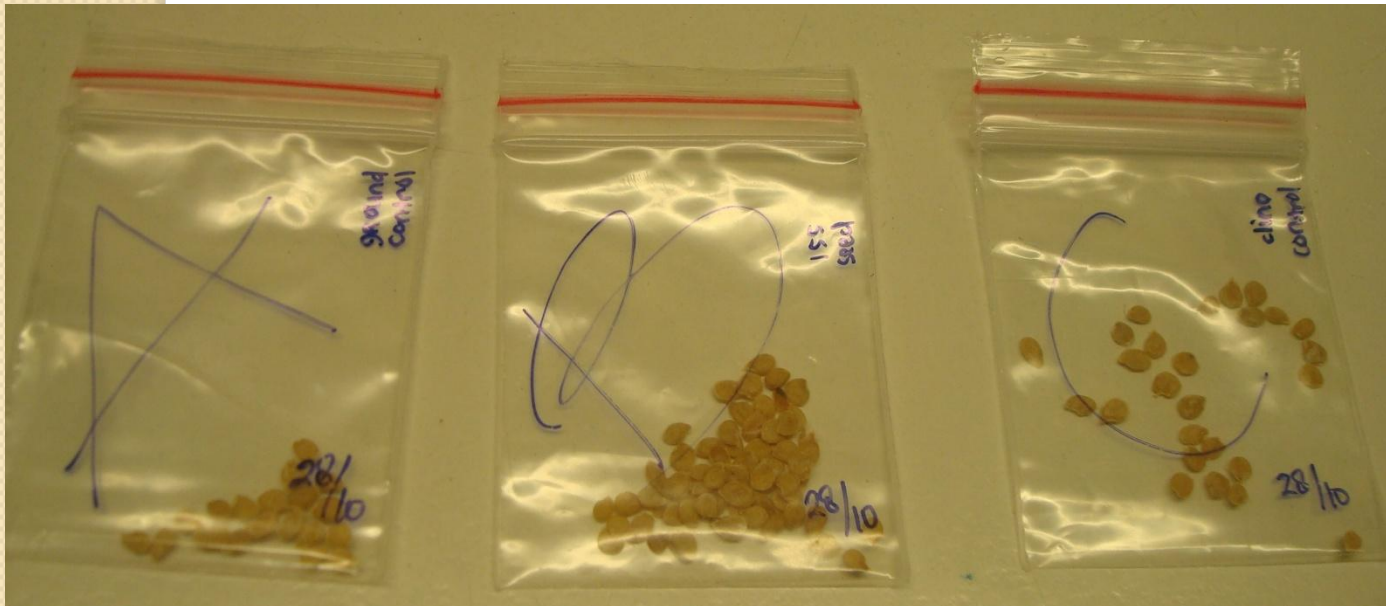


The sterilized seeds were dried on sterile tissue for several hours in laminar

Seeds Repackaging



The dried seeds were put in small packages, each packages contain 30 seeds

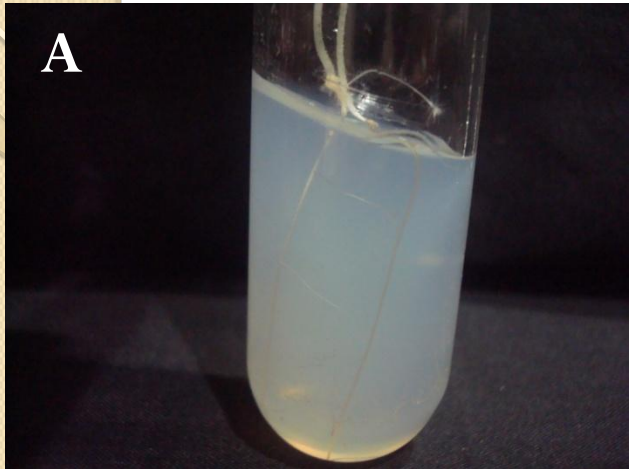


The packages were given code A for ground control seeds, B for seeds from ISS and C for clinostat control



Clinostat Verification

Experiment Results on 3D Clinostat → Dark Condition



Picture A and B are root and shoot of tomato seedlings in normal gravity, while C and D are the root and shoot of tomato seedlings after rotated for 3 days on a 3D clinostat

Experiment Results on 3D Clinostat → Dark Condition

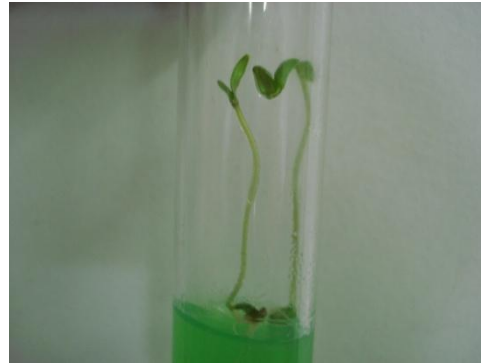


A is the tomato seedlings grown in normal gravity, B and C are the tomato seedlings after rotated for 3 days on 3D clinostat (red arrow: root)

Experiment Results on 3D Clinostat → Light Condition



0



3 x 24
hours



6 x 24
hours

Control



Clinostat

Experiment Results on 3D Clinostat → Light Condition



0 hour



3 x 24
hours

Control



Clinostat

Seeds Distribution

- The seeds in small packages were then distributed to junior high school student for science project competition, together with the ground control and clinostat seeds.



Technical Meeting of the competition



Seeds distribution



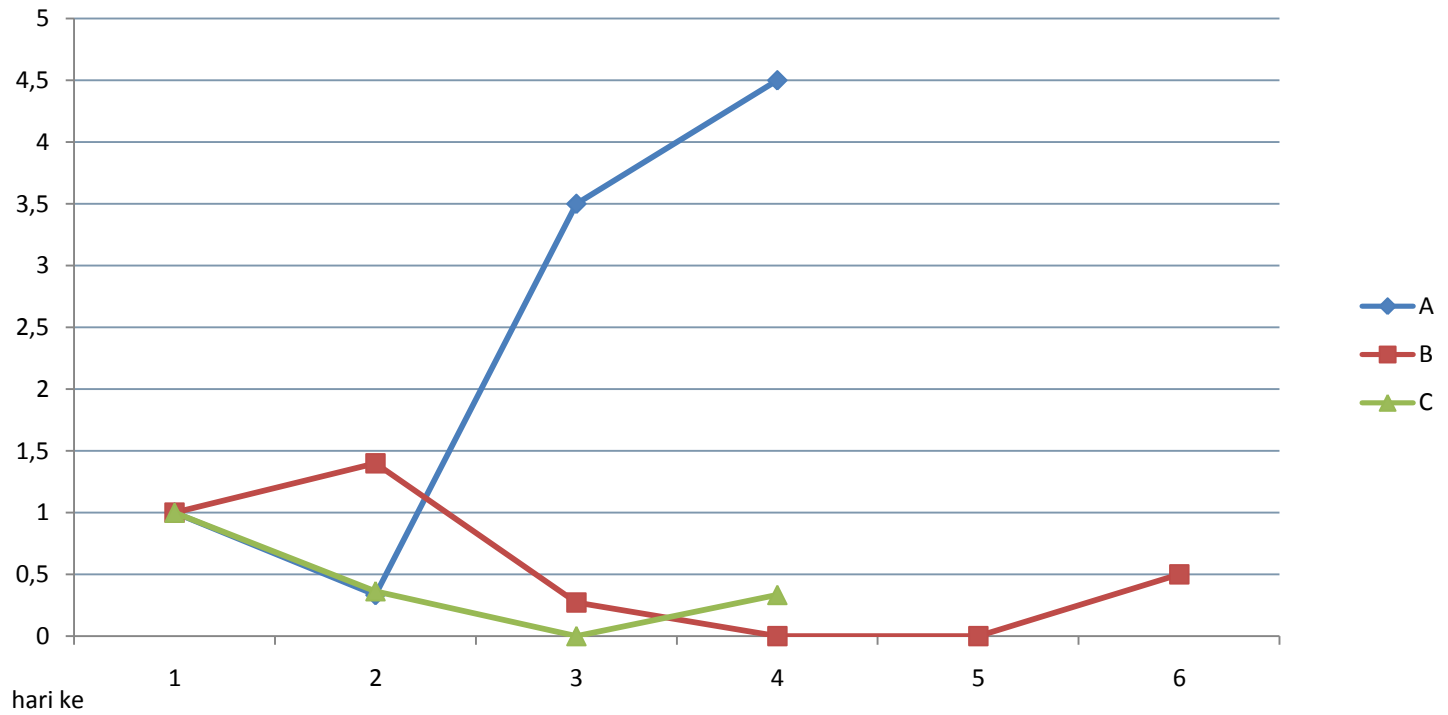
**A month later.....
(November 28, 2011)**

- **Observation reports; 3 finalists:**
- **Presentation of the winner**

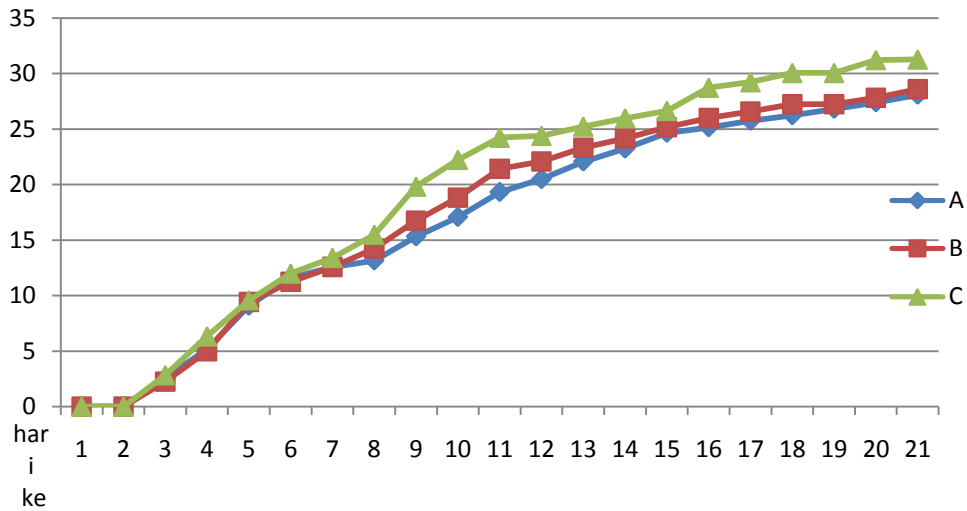


Three kinds of tomato seeds

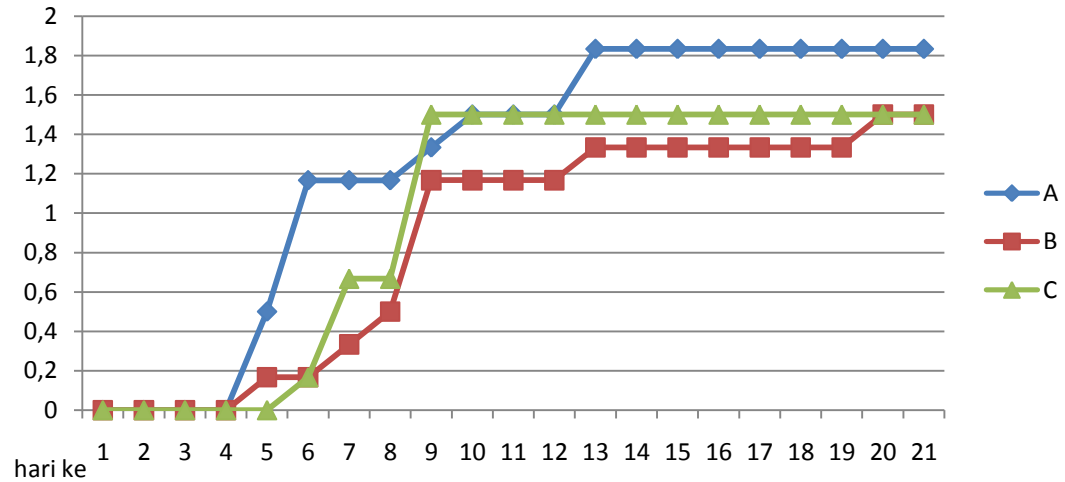
- Package A : 'normal' seeds
- Package B : 'space' seeds
- Package C : 'clinostat' seeds



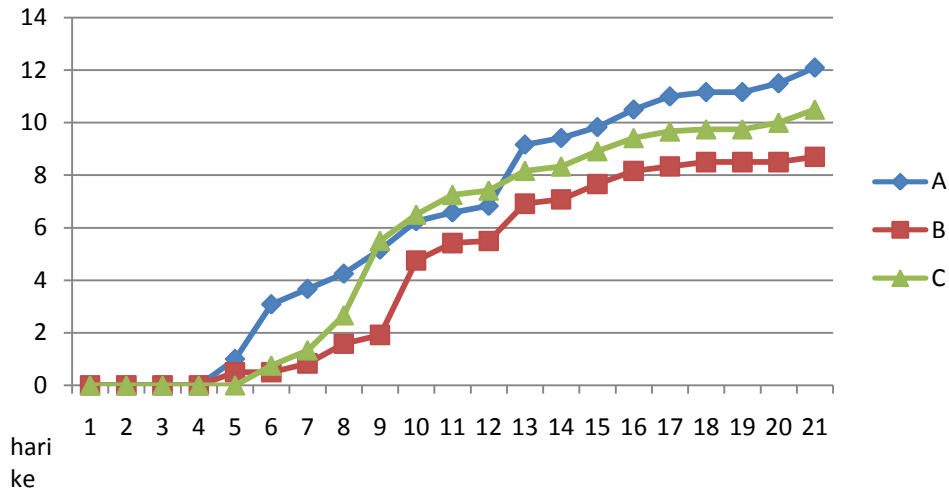
Growth rate day 1 – day 6



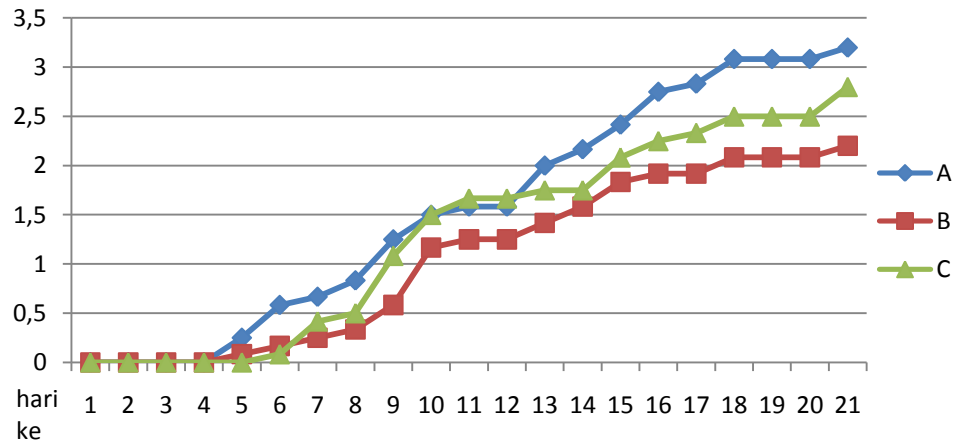
Height (day 1 – day 21)



Number of leaves, day 1 – day 21



Length of leaves, day 1 – day 21

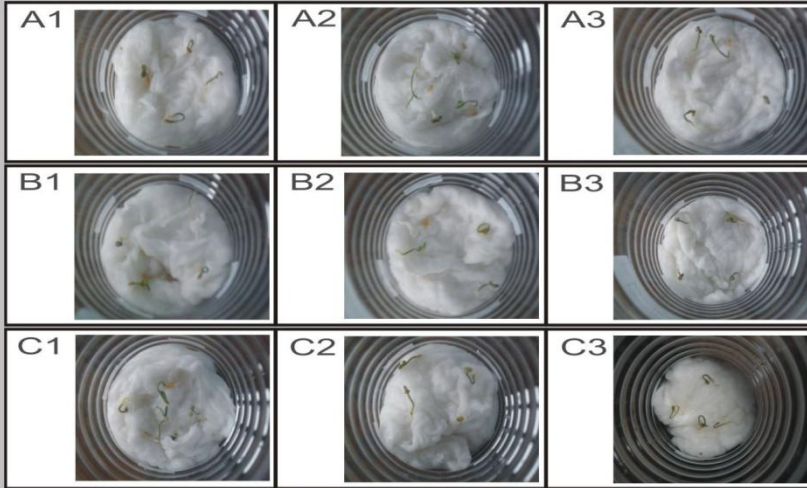


Width of leaves, day 1 – day 21

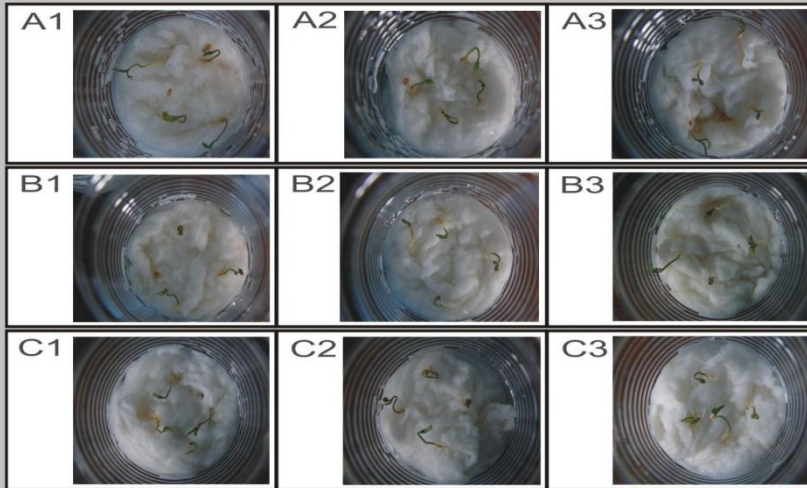
Growt of plant day 5, day 6, day 19, day 20

GAMBAR TAHAPAN PERKEMBANGAN BENIH TOMAT

Hari ke-5



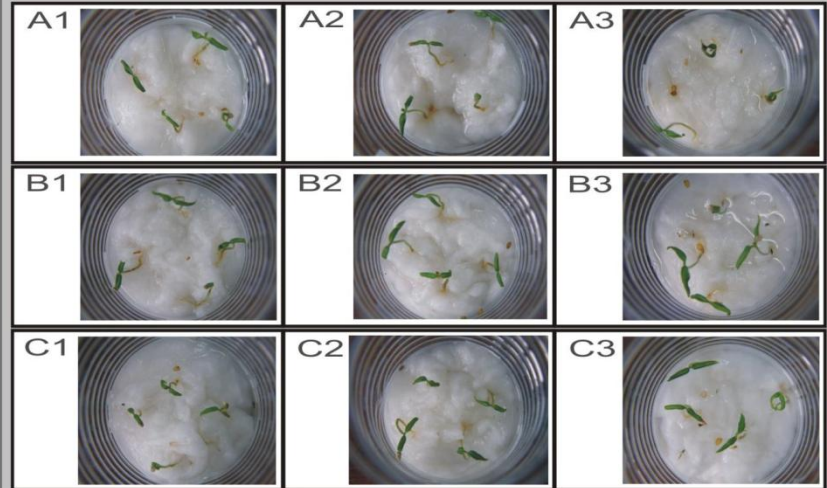
Hari ke-6



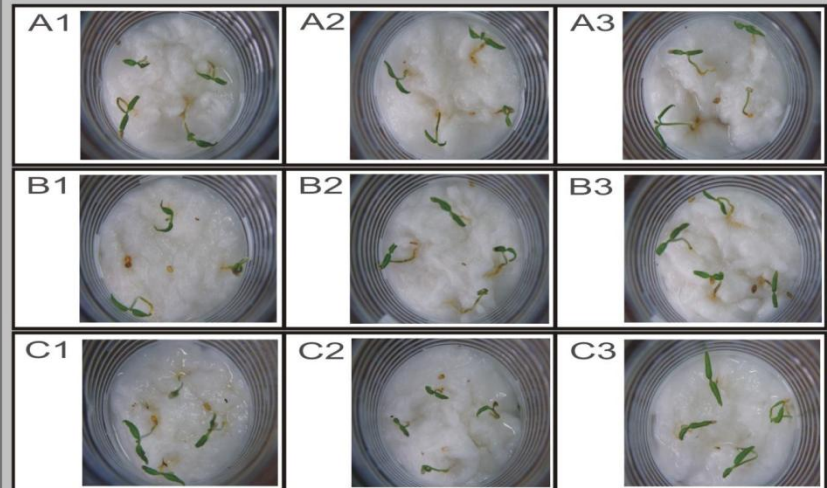
SMPK 5 BPK PENABUR Bandung

GAMBAR TAHAPAN PERKEMBANGAN BENIH TOMAT

Hari ke-19



Hari ke-20



SMPK 5 BPK PENABUR Bandung



Impatiens balsamina (Garden Balsam)



Seeds of Garden Balsam





Lab Experiment

- **Growth of *Impatiens Balsamina* L. seeds**

Seeds of *Impatiens Balsamina* L. in this research consists of control seeds, seeds treated 3D-clinostat and space seeds. Each kind of seeds (about 15 seeds) was grown on the cotton that placed in the bottles, duplo. These seeds were cleaned using 70% alcohol and submerged in the water for 24 hours. Afterwards, the seeds then placed on the cotton in dark condition for germination. After the seeds had successfully germinated, then the seeds continued grown in light condition. About 90-100% seeds has successfully germinated and continued to growth in light condition. After 5 days, morphologically, the ground (control seeds) was grown 2-3 mm, and radicula of control seeds was shorter than 3D-clinostat (4-6 mm) seeds and space seeds. After 10 days observation, the epicotyl growth of the control seeds were tend to have upright, while the epicotyl growth of 3D-clinostat seeds were tend to bend with no certain directions. However, the epicotyl growth of space seeds was more bending and did not have orientation.

The growth rate of 3D-clinostat seeds (Figure 2b) were the fastest while the ground (control, Figure 2a) seeds were the slowest.



Figure 1. Seeds Germination of *Impatiens Balsamina* L. (a) control (ground) seeds; (b) 3D clinostat seeds and (c) space seeds

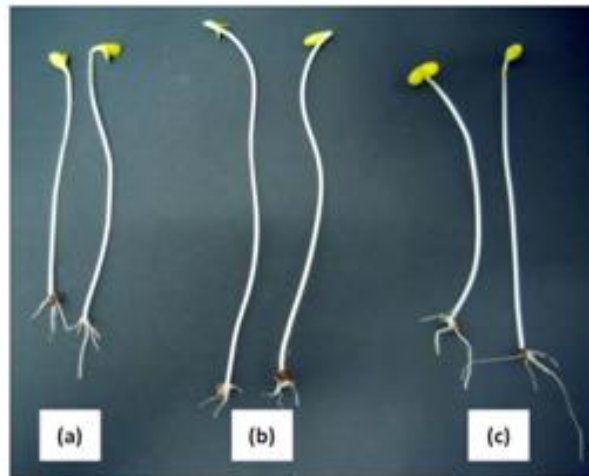



Figure 2. Growth of the seeds after 10 days (a) control (ground) seeds; (b) 3D clinostat seeds and (c) space seeds



L'Oreal Girls Science Camp May 2012

- 
- The seeds are distributed in March 2012
 - 15 schools are selected to introduce their result
 - Presentation of the finalists on 15 – 16 May 2012



L'Oreal Girls Science Camp



Presentation about 'SPACE' by LAPAN



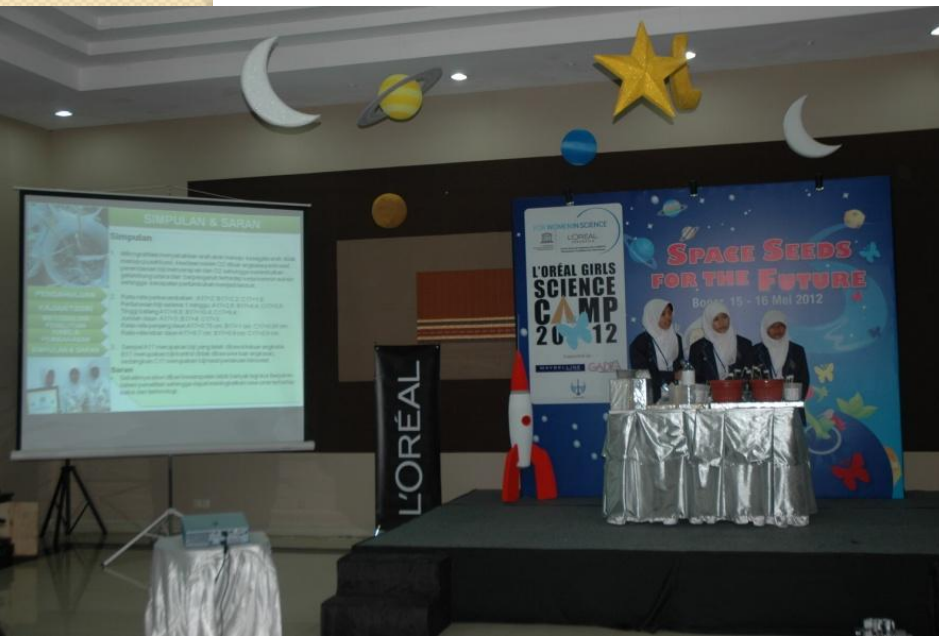
Water rocket competition

Preparing the Night Observation





Presentations by finalists





The Winner