

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the ISS and Beyond (7)

Author: Mrs. Funmilola Adebisi Oluwafemi
National Space Research and Development Agency (NASRDA), Abuja, Nigeria,
oluwafemifunmilola@gmail.com

INVESTIGATION OF GROWTH OF TEN SELECTED PLANTS UNDER SIMULATED
MICROGRAVITY

Abstract

On board spaceflight microgravity experiments are expensive and scarce. One of the simulated-microgravity instruments, clinostat was used as ground-based research to investigate the root-anatomy of ten selected plants at National Space Research and Development Agency (NASRDA), Nigeria collaborating with United-Nations Office for Outer Space Affairs under the Zero-Gravity Instrument Project by donating a two-dimensional clinostat to NASRDA. A rotation on clinostat is called "clinorotation". The selected plants due to their small seeds are cowpea, peanut, watermelon, okra, cucumber, cotton, wheat, sorghum, corn and rice. Plant root-anatomy is important for graviresponses. Root-curvature and growth-rate analysis were done on the roots of these plants.

Seeds of each plants were planted per experiment into 3 petri-dishes using plant-substrate called agar in a wet-chamber in vertical-positions. The following conditions were maintained throughout the experiment: humidity between 60 to 100%, temperature of 23degrees and light of 50lux. After 2 to 3 days of germination under normal earth gravity, the petri-dishes were labelled "1g-control", "90degree-turned" and "Clinorotated". The 1g-control labelled sample (maintained in the vertical-position) and the 90degree-turned labelled sample (rotated by 90degrees) were left under normal earth gravity to serve as controls for growth-rate analysis and root-curvature analysis for the clinorotated-sample respectively. The clinorotated-sample was mounted on clinostat under the following conditions: fast rotation-speed of 85rpm, rotational-axis angle of 90degrees and rotation-direction was clockwise. The photos of the 3 samples were taken every 30minutes. These observations were done varying between 2 to 6 hours per plant. After observations, the root-anatomy of these plants were studied using specialized-software called ImageJ to analyse the roots-angles and roots-lengths from the three sets of pictures taken. The grand average root-angles and root-lengths of all the seeds per plant were calculated per hour to give the root-curvatures and growth-rates respectively.

The results showed that the clinorotated-samples of the ten plants had reduced response to gravity per-hour in comparism to 90degree-turned samples. Their root-curvatures ranges from 1.33degree\hr to 28.25degree\hr for all the ten plants. This shows a positive response to microgravity. The clinorotated samples of eight plants except cotton and sorghum showed increased growth-rate per hour than the counterpart 1g-control samples. The growth-rates of these eight plants, ranges from 2mm\hr to 9.73mm\hr while cotton and sorghum had 6.08mm\hr and 2.13mm\hr respectively as reduced growth-rates. These results serve as preparation for future-space experiments on these plants. Conclusively, clinostat-rotation majorly affects plants growth positively. This will increase the productivity in sectors like agriculture.