MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond - Part 2 (7)

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

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.