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SUNFLOWER (HELIANTHUS ANNUUS L.) IN SPACE: SEEDS EXPOSED DURING 1984-1990 TO SPACE RADIATION ABOARD THE NASA LONG DURATION EXPOSURE FACILITY. Raymond D. Brigham, Texas A&M University, Texas Agricultural Experiment Station, Route 3, Box 219, Lubbock, Texas 79401 USA.

Seeds of the ornamental sunflower cultivar 'Piccolo' were deployed into global orbit on April 7, 1984, by the crew of the space shuttle Challenger operated by the National Aeronautics and Space Administration (NASA). Seeds were on board the Long Duration Exposure Facility (LDEF) along with 12.5 million tomato seeds and 1.9 million seeds representing 106 species, 97 genera, and 55 plant families. The experiment was planned and supervised by Dr. Jim Alston, George W. Park Seed Co., Inc., Greenwood, South Carolina, USA.

The LDEF completed 32,422 orbits in free flight, 296 statute miles above the earth, and was retrieved January 12, 1990, by the crew of the space shuttle Columbia, which landed January 20, 1990. The seed tray was in the F-2 position on the LDEF. This position (F-2) was one row off the trailing edge or facet and first ring from the space end. The tray was removed from the LDEF on February 23, 1990, and returned to Park Seed next day. The canister that contained the seeds was opened on March 1.

Prior to the flight, the seeds were layered in canisters within the LDEF. Canister Number 6 was sealed with one atmosphere pressure, and two canisters (one white and one black) were vented to the vacuum of space. The white vented canister was on the top of the tray, and received the full radiation dose. The black vented canister was under one of the other canisters, and was shielded from part of the radiation. The seeds within Canister Number 6 were arranged in four layers (A,B,C, and D), with layer A being toward space and D toward the center axis of the LDEF. Layer A received 660 rads total radiation, which was made up of 90-95% protons and 5-10% cosmic galactic rays. Layer D received 350 rads total radiation.

Seeds were planted in the greenhouse in a soil mix in peat pots May 24, 1990 at Lubbock, Texas. Only 150 seeds were available from each of the four layers in Canister Number 6. After 4 weeks, 14 percent

of the seeds from the sealed canister survived, while only 2% from the white vented canister survived, and only 1.25% from the black vented canister survived. This compares with 72% survival of plants from May 1990 stock of the cultivar Piccolo. Apparently the dessication of seeds in the vented canisters reduced viability drastically, compared to seeds stored under one atmosphere pressure. Radiation dosage did not appear to have significant effects on seed viability in the white and black vented canisters. Seedlings were generally weak, and did not show visible mutations. Because of self sterility, seeds were not produced by plants which bloomed.

The Piccolo cultivar has very small seeds (200 = 1.15g) and possibly was chosen for exposure in space for this reason. If future flights are made with sunflower seeds on board, an oilseed type selection with complete self fertility would be desirable.