This study evaluates the volumetric imaging performance of two prototyped 62+62 row–column-addressed (RCA) 2-D array transducer probes using three Synthetic Aperture Imaging (SAI) emission sequences and two different beamformers. The probes are fabricated using capacitive micromachined ultrasonic transducer (CMUT), and piezoelectric transducer (PZT) technology. Both have integrated apodization to reduce ghost echoes and are designed with similar acoustical features i.e., 3MHz center frequency, l/2-pitch, and 24.8×24.8mm² active footprint. Raw RF data are obtained using an experimental research ultrasound scanner, SARUS. The SAI sequences are designed for imaging down to 14 cm at a volume rate of 88 Hz. Two beamforming methods: Spatial matched filtering and rowcolumn adapted delay-and-sum are used for beamforming the RF data. The imaging quality is investigated through simulations and phantom measurements. Both probes on average have similar lateral full-width at half-maximum (FWHM) values, but the PZT probe has 20% smaller cystic resolution values and 70% larger contrast-to-noise ratio compared to the CMUT probe. The CMUT probe can penetrate down to 15 cm, and the PZT probe down to 30 cm. The CMUT probe has 17% smaller axial FWHM values. The matched filter focusing shows and improved B-mode image for measurements on a cyst phantom with an improved speckle pattern and better visualization of deeper lying cysts. The results of this study demonstrate the potentials of RCA 2-D arrays against fully addressed 2-D arrays, which are low channel count (e.g. 124 instead of 3,844), low acoustic intensity (MI ≤0.88 and Ispta ≤5.5mW/cm²), and high penetration depth (down to 30 cm), which makes 3-D imaging at high volume rates possible with equipment in the price range of conventional 2-D imaging.