

# Quality and Root Morphology of Onion (*Allium cepa* L) in Response to Varying Planting Geometries

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**Abstract**—India is the second largest producer of onion (*Allium cepa* L.) after China, but the average yield ( $10.38 \text{ t ha}^{-1}$ ) is noticeably lower than world's productivity of  $18.08 \text{ t ha}^{-1}$ . Among various factors, poor water and nutrient management strategies significantly contribute to its low productivity in India. Being a shallow-rooted crop, onion is sensitive to water stress and requires frequent and light irrigation to avoid water deficit and effectively recharge the plant root zone. Water stress during the vegetative and reproductive stage of the crop considerably influences the growth and root development, which consequently lead to yield and quality decline. Field experiment was conducted at the experimental area of Water Technology Centre, IARI, New Delhi, during rabi season of 2012-13 and 2013-2014 in a sandy loam soil, to study the quality and root morphology of onion (*Allium cepa* L.) in response to planting geometries. The study comprised of three crop geometries ( $S_1$ ,  $S_2$  and  $S_3$ ) having bed widths of 30 cm containing 2 rows of onions at 15 cm spacing ( $S_1$ ), 45 cm bed width containing 3 rows of onions ( $S_2$ ) and 60 cm bed width containing 4 rows of onion ( $S_3$ ) along with Ridge and Furrow method of irrigation. Two commonly grown onion varieties namely L28 and Pusa Red were selected for field experimentation. Results revealed that root morphology and quality parameters of the selected varieties of onion were significantly affected by different planting geometries. The maximum total root length was recorded in crop geometry  $S_1$  (62.6 cm) followed by  $S_2$  (55.9 cm) and  $S_3$  (47.9 cm), however among varieties Pusa Red (60.9 cm) recorded higher compared to L 28 (49.9 cm). Among the studied crop geometries average root surface area were significantly ( $P < 0.05$ ) higher for the planting geometry  $S_2$  than  $S_3$  and  $S_1$ . Further, onion variety Pusa Red having significantly high root volume, average root diameter and surface area than L28. There was significant difference in the quality parameters on onion like bulb weight, equatorial diameter and total soluble solids (TSS), but the impact was found to be a varietal attribute rather than influence of planting geometries. The variety Pusa Red had recorded significantly higher TSS content (12.7 %) than the variety L28 (9.7 %). Overall, data revealed that crop geometry having 45 cm bed width containing 3 rows of onions improved root development resulting in better allometry and response were better observed with variety Pusa Red than L28. These findings were corroborated with the yield pattern obtained in the study.

**Keywords:** Bed width, Equatorial diameter, Root study, Pusa red, Total soluble solids.