

Effect of Mulching on Soil Physical Properties under Dry Zone Condition: Evidence from Knol-khol (*Brassica oleracea* var. *gongylodes*) Cultivation in Kilinochchi, Sri Lanka

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Soil physical degradation and rapid moisture loss are major constraints to vegetable production in the dry zone of Sri Lanka. Although mulching is widely used to conserve soil moisture, information on its effects on soil physical properties under local conditions is limited. This study evaluated the impact of different mulching materials on soil moisture storage, soil temperature, bulk density, and soil organic matter during Knol-khol (*Brassica oleracea* var. *gongylodes*) cultivation in Kilinochchi District, Sri Lanka. A field experiment was conducted using a Randomized Complete Block Design (RCBD) with four treatments: paddy straw mulch, palmyra dry leaves mulch, polythene mulch, and a no-mulch control, each with three replicates. Organic mulches were applied at a thickness of 15 cm one week before transplanting. Soil moisture storage, soil temperature, bulk density, and soil organic matter were measured throughout the cropping period using standard field and laboratory methods. Data were analyzed using analysis of variance (ANOVA), and treatment means were compared using Dunnett's test at a 95% confidence level ($p \leq 0.05$). Mulching significantly improved soil physical properties. Mean soil moisture storage was highest under palmyra dry leaves mulch ($23.8 \pm 1.9\%$), followed by paddy straw ($21.6 \pm 1.7\%$), polythene mulch ($20.2 \pm 1.5\%$), and the control ($17.4 \pm 1.6\%$). Organic mulches also moderated soil temperature, recording lower values under palmyra dry leaves ($27.1 \pm 0.8\text{ }^{\circ}\text{C}$) and paddy straw ($27.8 \pm 0.9\text{ }^{\circ}\text{C}$) than under polythene mulch ($29.4 \pm 1.0\text{ }^{\circ}\text{C}$) and the control ($30.2 \pm 1.2\text{ }^{\circ}\text{C}$). Bulk density was lowest under palmyra dry leaves ($1.42 \pm 0.05\text{ g cm}^{-3}$), while soil organic matter increased to $1.26 \pm 0.08\%$ compared with $1.02 \pm 0.05\%$ in the control. The results demonstrate that organic mulching, particularly palmyra dry leaves, is an effective and sustainable option for improving soil physical conditions, conserving moisture, and supporting Knol-khol cultivation in dry-zone environments.

Keywords: Bulk density, Mulching, Soil Moisture, Soil physical properties, Soil Temperature