Thesis Title	Application of Room Cooling and Thermal Insulation Materials in Cool Chain Management of Okra
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ABSTRACT

Temperature and relative humidity (RH) fluctuations during storage and transportation cause wilting and heat damage before processing of okra during storage and transportation. This work was the first to study room cooling and thermal-insulation materials for cool chain management for reduction of postharvest losses of okra and other perishable crops.

In the first trial, a typical handling (TP) and covering with perforated linear low-density polyethylene (P-LLDPE) without room cooling were employed as control treatments compared with developing handling (DH). After either room cooling at 0 °C for 2 h or no cooling, the okra pods were covered with three different materials: 1) perforated linear low-density polyethylene (P-LLDPE), 2) two layers of heat reflective sheet with thin nonwoven (HRS+TNNW), and 3) metalized foam sheet (MFS). After room cooling, HRS+TNNW and MFS covers (10 h) delayed a rise of pulp temperature to reach 18 °C, compared to P-LLDPE (2 h). TP treatment had highest postharvest losses (mass loss and the incidence of decay) (65%), followed by P-LLDPE without cooling (59%), MFS without cooling (52%), MFS with cooling (27%), HRS+TNNW without cooling (26%), and HRS+TNNW with cooling (15%). Room cooling demonstrated an important pretreatment before applying thermal insulation covers to delay an increase of temperature and to protect heat accumulation.

In the second trial, efficiency of different thermal insulation materials to minimize temperature rise and fluctuation was determined. Room cooling at 0 °C for 2 h was applied in okra samples before covering. Four thermal insulation covering materials: (1) heat reflective sheet with thin nonwoven (HRS+TNNW), (2) heat refractive sheet with thick nonwoven (HRS+TKNW), (3) metalized Tyvek® (MTyvek) and (4) metalized foam sheet (MFS) were studied and compared with perforated linear low-density polyethylene (P-LLDPE) and no cover as control treatment. The material properties including thickness, thermal heat energy (Q_x), thermal resistance (R-value), air permeability and water vapor permeability (WVP) were investigated. The proper thermal insulation material for okra covering should have low Q_x, high R-value and moderate WVP values. HRS+TNNW and HRS+TKNW had the lowest rate of air and pulp temperature changes. HRS+TNNW cover (5%) exhibited the lowest postharvest losses followed by HRS+TKNW (10%), P-LLDPE (11%), MFS (13%), no cover (18%) and MTyvek (23%), respectively.

In conclusion, the combination of room cooling and HRS+TNNW exhibited the greatest efficiency for maintaining cool temperature and minimizing postharvest loss of okra during simulated storage and transportation. HRS+TNNW prototype had good performance in terms of material and okra quality comparable to the commercial cover (MFS). In future study, HRS+TNNW is suggested to improve material functions or properties to apply in okra and other fresh produce.

Keywords: Covering Material, Decay, Metalized Foam Sheet, Nonwoven, Okra, Postharvest Loss