

ABSTRACT

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Set of experiments were conducted at Horticulture Research Station (HRS), Rajikot, Jumla (2,390 m asl) from 2011-2014 to assess current production, postharvest handling, processing and marketing situation of apple; to evaluate spur type apple cultivars; to identify appropriate cushioning materials for packaging and transportation of apple from production site to collection centre and to identify appropriate packaging container and packaging method for transportation of apple from Jumla to Nepalgunj.

For production system and market assessment, primary data were collected by focus group discussion (FGD) and direct field observations while secondary data were collected from the publications of various organizations. Area covered by bearing apple trees was 409 ha with total production and productivity of 3,500 mt and 8.6 mt/ha, respectively. Out of total production, 43 %, 14 % and 12 % have been used for local consumption, export and processing, respectively whereas 31 % fruits were lost due to decay. The study revealed that about 40 % of the fruit loss occurred during harvesting and postharvest handling practices. Farm gate price in Jumla and retail price at Nepalgunj market was NRs. 20 and NRs. 140, respectively. One of the reasons for greater variation in farm gate and retail price might be due to compensation of higher transportation losses. Limiting factors for quality production and marketing of apple were lack of regular bearing cultivars, poor orchard management practices, incidence of various pest and diseases, scattered production pockets, inadequate transportation and storage facilities, inappropriate handling and improper packaging. Germplasm of twenty-five spur type apple cultivars introduced from India and Canada were evaluated at HRS, Rajikot, Jumla in a randomized complete block design (RCBD) with 3 replications for Canadian and 7 replications for Indian cultivars. Among them, Starkimson Delicious was found superior after 3 years of planting in terms of tree growth and vigor (273 cm height, 80 mm girth diameter, 3.2 m canopy diameter), maturity (early), fruit size (78 mm), fruit weight (192 g) and TSS/TA ratio (66).

Five different cushioning materials (woolen shawl, Himalayan foundation grass, news paper, plastic and control) with three apple cultivars were evaluated in a factorial completely randomized design (CRD) with four replications. The result revealed that packaging of fruits in conical bamboo baskets lining with green Himalayan foundation grass or woolen shawl were found the most efficacious, low cost and easily available cushioning materials to reduce bruising and scratching damage for packaging and transportation from orchard to collection center. Postharvest loss in treatment without cushioning material was 24.0 % which was reduced to 11.3 % in treatment with green Himalayan foundation grass cushioning material. Fruits of Red Delicious cultivar had

minimum damage during transportation (13.3 %), less physiological weight loss (11.4 %), lesser spoilage (10.1 %) and higher sensory rating (4.8) three months after storage under ambient condition ($11.8 \pm 3.8^{\circ}$ C and 65 % RH) at HRS, Rajikot, Jumla, thus could be recommended for long term storage. Besides having highest firmness (5.9 kg/cm^2) for Golden Delicious, they were less preferred by the consumers because of more sensitive to damage during transportation and more shrivelling of fruits during storage. No significant variation was observed in TSS, TA, juice content, TSS/TA ratio and starch index with cushioning materials. However, TSS, TSS/TA ratio, starch index increased, while TA, firmness and juice content decreased with storage period in all treatments.

Similarly, eight different CFB boxes (5 plies CFB boxes having 140 psi, 160 psi, 180 psi bursting strength; 7 plies CFB boxes having 140 psi, 160 psi, 180 psi bursting strength; 7 plies CFB box recommended by Fruit Development Directorate and 3 plies Beer carton) were evaluated in completely randomized design (CRD) with 3 replications. The result revealed that CFB box of 10 kg capacity having 7 plies 180 psi bursting strength was identified as most appropriate container for packaging and transportation of Red Delicious apple fruits from production site to distant markets (318 km). Postharvest loss in 3 plies Beer cartons was 20.0 % which was reduced to 5.5 % in 7 plies 180 psi CFB boxes. Economic analysis revealed that additional benefit of NRs. 70,625 per truckload could be obtained in 7 plies 180 psi CFB boxes as compared to 3 plies Beer cartons.

Likewise, sixteen different packaging methods (wrapping or without wrapping of individual fruit with Styrofoam, separation or without separation of layers with deck plate, trimming or without trimming of stalk, with or without ventilation on CFB box) were evaluated in a factorial completely randomized design (CRD) with 3 replications. Wrapping of stalk trimmed individual fruits with Styrofoam in ventilated CFB box separated in layers with deck plate was found best method for packaging and transportation apples from production site to distant markets. Postharvest loss in conventional packaging method was 18.2 % which was reduced to 3.8 % in improved packaging method. Economic analysis revealed that additional benefit of NRs. 95,250 per truckload was obtained in improved packaging method (deck plate separation, trimming of stalk, wrapping of individual fruit and ventilations on CFB boxes) as compared to traditional packaging.