

# Reducing preharvest food losses in spinach with the implementation of high tunnels

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Scientia Horticulturae 265: 109268. (2020)

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## Abstract

Preharvest losses of fruits and vegetables constitute a considerable amount of the total food losses that occur in the food chain. Preharvest losses are typically related to a decrease and/or loss of marketable yield due to reduced crop performance and/or crop damage related to weather and/or pests and plant diseases. However, physical and nutritional quality are also important parameters that can contribute to food losses. There are numerous reports in the literature that indicate that small-acreage farmers in the U.S. can utilize high tunnels to increase the yield of various fruit and vegetable crops. However, it is unclear if the high tunnel production system affects the preharvest food losses of spinach, particularly in regard to physical and nutritional quality. The goal of this study was to examine the effect of the high tunnel production system on preharvest food losses of fall-planted spinach, *Spinacia oleracea*, cv. 'Corvair'. Comparative open field and high tunnel trials were conducted at the Kansas State University Olathe Horticulture Research and Extension Center from 2014 to 2017 (three growing seasons). A systems approach was utilized, consisting of six replications per production system. The experiments were conducted using organic production practices. Spinach quality was assessed on the day of harvest during years 2 and 3 of the experiment. Spinach leaves were harvested at full maturity and the preharvest losses were evaluated in regards to yield, percent marketability and physical and nutritional quality. Spinach grown in the high tunnels had 126%–528.6% higher marketable yield ( $P < 0.001$ ) and 11.5%–26.5% higher percent marketability ( $P < 0.001$ ) when compared to open field production during the three years of the study. The high tunnels produced spinach with 30%–50% larger leaves ( $P < 0.001$ ) and 2.1%–2.4% higher water content ( $P < 0.001$ ) when compared to spinach grown in the open field. Spinach grown in the open field

plots had significantly higher antioxidant capacity (ORAC & FRAP) in both years. There was an inconsistent effect on total phenolic content and ascorbic acid content, with these phytochemicals demonstrating significantly higher values for the open field plots in one of the two years examined. Our results indicate that using high tunnels for production of spinach can reduce the preharvest food losses as the results of increased productivity and marketability and premium crop quality.