Improving canopy contact olive harvester efficiency with mechanical pruning

L. Ferguson, K. Glozer, C. Crisosto, U.A. Rosa, S. Castro-Garcia, E.J. Fichtner, J.X. Guinard, S.M. Lee, W.H. Krueger, J.A. Miles, J.K. Burns

Acta Horticulturae 965: 83-87. 2012.

Abstract

The California table olive industry's primary cultivar is the *Olea europea* 'Manzanillo' which is harvested when physiologically immature and processed with oxidation to produce the 'California Black Ripe' table olive. Hand harvest costs are the single largest production cost, averaging 50-75% of gross return. Economically, developing mechanical harvesting is necessary for survival of California's industry. An abscission agent to decrease fruit removal force of the physiologically immature olives has not been identified, so increases in final harvesting efficiency must come from either engineering, improving harvester technology or by modifying the tree to increase final mechanical harvesting efficiency. A canopy contact head harvester was evaluated in a 17-year-old hedgerow olive orchard with rows oriented N-S and spaced at 3.9 m (13 ft) in row 7.9 m (26 ft) between. Six, 83-tree rows were mechanically hedged 1.8 m (6 ft) from the trunk on alternating sides in 2008, 2009 and 2011 and topped at 3.7 m (12 ft) in 2008 and 2009. Six rows were conventionally pruned. Both sets of 6 rows were skirted 1 m (3.3 ft) from the ground. All pruning was done in early June after fruit averaged more than 5 mm in diameter. Total crop failures in 2008 and 2009, and a mechanical failure in 2011, prevented data collection on harvester efficiency for those crop years. What is reported here is the effect of mechanical pruning on olive yield, quality and alternate bearing for all four experimental years and effects on harvest efficiency in 2010 only. The mechanical topping and hedging produced no significant difference in fruit yield or quality in the initial 2 years, 2008 and 2009, due to crop failures. In 2010 the mechanically topped and hedged trees produced 21,302.4 kg/ha (9.51 t/acre), significantly less than the 27,820.8 (12.42 t/acre) produced by the hand-pruned trees. In 2011 the mechanically topped and hedged trees produced 17,673.6 kg/ha (7.89 t/acre) versus 6,204.8 kg/ha (2.77 t/acre)

for the hand-pruned trees. From 2008 through 2011, the mechanically topped and hedged trees produced a cumulative 40,790.4 kg/ha (18.21 t/acre) averaging an annual 10,192.0 (4.5 t/acre). They produced a cumulative increase of 2,844.8 kg/ha (1.27 t/acre) or an average of +694.4 kg/ha (+0.31 t/ac) annually more than the hand-pruned trees. There were no significant differences in canning percentages per ton, adjusted crop value at the receiving station or in the sensory and consumer evaluations of the processed olives. In 2010, the fruit removal force averaged 0.58 kg in mechanically pruned rows and 0.55 kg in hand-pruned rows – not significantly different. The canopy contact head harvester was 7.08% more efficient in the mechanically pruned rows averaging a statistically significant 57.35% average final harvest removal efficiency in versus 50.27% efficiency in hand-pruned rows. These results thus far indicate a mechanically pruned hedgerow configuration generated by topping and hedging alternate sides in a 3 year cycle will enhance mechanical harvesting efficiency by producing the flat “wall” of hanging olive shoots that make the fruit more accessible to a canopy contact harvester head. In addition, a mechanically pruned hedgerow configuration also may have the ability to decrease alternate bearing by, we suggest, generating a more equal proportion of fruiting and non-fruiting shoots.