Establishing and Training Manzanillo Table Olives For Mechanical Harvest

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Table olives in California are hand harvested. According to a 2004 UC cost study, harvest is responsible for 57% of the total cost of table olive production. Prices paid to growers were below the total cost of production for 2003 through 2005. From 1997 to 2000, the California Olive Committee (COC), the table olive marketing order, sponsored the development of a mechanical harvester for table olives. Prototype machines were developed which had vibrating rods which engaged the tree canopy, resulting in a canopy shake. Although these machines looked promising, they had two major drawbacks: 1.) Efficiency of harvest. When the picking head came into close proximity to the fruit it was removed. However, leading and trailing canopy edges and inside fruit proved to be problematic because it was difficult to get the head close to fruit located in these positions. Fruit removal was often disappointing. Difficulty in removing the fruit and catching the removed fruit resulted in only 54% of the fruit being successfully harvested in one University study. 2.) Fruit damage. The fruit can be damaged in the removal process. While this damage may appear similar to what may occur with hand harvest, the bruises are generally deeper and more severe.

If a tree canopy could be created in which all of the fruit was accessible to the picking head, a much improved harvest efficiency should be attainable. The ideal tree and orchard configuration would appear to be a close spaced hedgerow system which would present a flat fruiting wall to the harvester. A thin fruiting canopy approximately 6 feet in width and approximately 12 feet high would be appear to be ideal for maximum machine efficiency. With a narrow tree canopy and tree height such as this, a narrower row spacing will be necessary to achieve maximum yields.

Objectives:

The objectives of this work are to: 1.) Develop a narrow canopy hedgerow to facilitate mechanical harvest 2.) Evaluate and demonstrate the feasibility of a high density hedgerow developed specifically for mechanical harvest. 3.) Compare different training methods for developing a narrow canopy hedgerow.

Methods:

In the spring of 2000, Manzanillo variety table olives were planted on 2 acres at the Nickel's Estate in Arbuckle with a north-south row orientation and a tree spacing of 12 feet in the row and 18 feet between rows. The selected training treatments included "conventional" and three Espalier treatments. The conventionally pruned trees will be trained and pruned conventionally for as long as the space allows. With the Espalier treatments, permanent limbs are being trained parallel to the row in a narrow plane and temporary fruiting wood extending approximately three feet from the center axis on the east and west side of the canopy is being developed. The Espalier treatments are: Free Standing, where pruning alone is used to conform the trees to the system, Trellised Woven, where potentially permanent limbs are woven between two wires spaced at 4 and and 7 feet and Trellised Tied where potentially permanent limbs are tied to the wires. A third wire at 10 feet was added to the trellised treatments during the summer of 2005 and will be used to train the trellised treatments as they develop. The treatments are arranged in a randomized complete block design and consist of

three rows of either seven or eight trees. There are four replications of each treatment. Harvest data is being collected from the center row of each treatment. During 2005 we were only able to collect yield data from three of the four replicates.

Originally 6 trees of the Sevillano variety were strategically placed in the planting to provide for cross pollination for the partially self incompatible Manzanillo. Due to dissapointing growth of these trees, cross pollination was inadequate. Even though there was a good bloom, the fruit set for 2003 was disappointing and did not warrant harvest. During the summer of 2003, the center row of the planting was topworked to Sevillano to provide for adequate cross pollination in the future. During bloom in the spring of 2004 and 2005, the block was artificially cross pollinated using Sevillano pollen. The grafted pollinators have developed and artificial pollinization will be discontinued.

Results:

Fruit set and yields were very good for 2004, the fourth year, and did not vary significantly between the treatments (Table 1). The heavy crop in 2004 resulted in reduced bloom and crop in 2005. High variability in crop load and reduced replication resulted in no significant differences in yield or value per ton for any of the treatments in 2005. However, the trellised and tied treatment had a yield that was nearly twice any of the other treatments. This resulted in a significantly higher value per acre than the other treatments. This treatment was pruned less than the other treatments and there was a trend toward smaller less valuable fruit.

Table 1. Nickel's Hedgerow Olive Harvest, 2004 and 2005

	2004			2005			Accum. Yield (Tons/Ac.)
Treatment	Tons/Ac.	$/Ton	$/Ac.	Tons/Ac.	$/Ton	$/Ac.	
Conventional	4.09	539	2124	1.75	685	1185 a	5.84
Free Standing Espalier	3.66	557	1992	1.51	656	986 a	5.17
Espalier, Trellised, Woven	4.21	491	2038	1.68	647	1086 a	5.89
Espalier, Trellised, Tied	3.58	573	2005	3.45	640	2164 b	7.03
	ns	ns	ns	ns	ns		

Discussion:

When this trial was initiated, it seemed likely that mechanical harvest would soon be common for California table olives. Since these trees were planted, one of the two major canners stopped accepting mechanically harvested fruit due to concerns related to fruit damage. In 2006 the California Olive Committee will be funding a project to quantify and try to address fruit damage concerns related to the previously developed harvester. They are also funding research to develop a fruit loosening agent which would facilitate any type of mechanical harvest. It is hoped that this renewed interest in mechanical harvest will result in a machine being available for testing at Nickels in the future.

This type of tree configuration would be adaptable to other types of mechanical harvest. During 2005 we used these trees to assist in the testing of a harvester developed at Chico State which uses large fans and pulsating air to remove fruit. This machine showed promise and warrants further development

Having these trees will allow us to study the performance of table olives in this type of orchard configuration and allow us to quickly take advantage of new developments in mechanical harvest.