

#### **Mechanical Pruning Developments**

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### Why is Mechanical Pruning Necessary?

- Hand pruning is a costly method in Super High Density due to the high number of trees per acre and rising labor costs
- Lack of regrowth in the bottom two thirds of the canopy
- Rejuvenation of fruiting wood after years of mechanical harvest
- Maximize the amount of potential fruit positions in fruiting zone



# **Canopy Management**

- Pruning programs must:
  - Open the canopy and allow light penetration to increase growth and limit disease pressure
  - Allow for optimal fruit removal in mechanical harvest
- Remove large limbs coming into tree row that can interfere with mechanical harvest
- Increase lateral growth down the tree row and reduce excessive vigor into the centers
- Maximize the rejuvenation of fruiting wood to keep orchard productive



# Canopy Management Issues in Super High Density



### "Mushroom Effect"

- Response to repeated topping cut
- Trees natural tendency towards apical dominance
- Shades bottom two thirds of canopy
- Concentrates fruiting zone at the top of canopy





#### **Mechanical Harvest Damage**



#### **Interior Defoliation of Canopy**



### Long Spindle Growth



Typical Growth from Central leader in Arbequina Variety

Multiple Shoots Spurred by Tipping Cuts



# **Excessively Vigorous Bottom Growth**

- Wasted energy at the base of the canopy
- Inhibits catch frame of harvester to collect the maximum amount of fruit
- Increases potential fruit contact with herbicide





# California Olive Ranch: Hand Pruning Program

# **COR Hand Pruning**

- Goal
  - Increase harvester fruit removal
  - Increase light penetration
  - Decrease head width
  - Encourage dominate lateral growth down the hedgerow
  - Be cost effective and simple!
- Methods
  - Remove dominant lateral leaders coming into tree row
  - One large lopper cut into the top of the canopy to increase light penetration
  - 6-8 labor hours per acre



Large Cuts of 1" or Greater Wood



### Selective Hand Removal of Lateral Branches



#### Large Cut to Top of Canopy





### **Issues with Hand Pruning Method**

- Does not solve interior defoliation issue
- Requires 6-8 labor hours per acre or a cost of \$80-\$100 per acre
- Limits removal of limbs damaged by mechanical harvest
- Selective hand thinning cuts are not effective in creating multiple fruit branches





# Methods of Mechanical Pruning



# **Mechanical Flat Topping**

- Topping in young trees prior to winter in critical in heavy wind areas
- Rotary saws optimal in full production trees
- Harvest considerations:
  - Toppers must have adequate "throw" to eliminate trash in the canopy
  - Topping should be done 1-2 months prior to harvest to allow and loose trash to exit the canopy
  - Generally top in August to maintain an 8' foot fruiting zone





## Mechanical Gable Topping

- Potential to alleviate "mushroom effect" in older production trees
- Directs sunlight into bottom two thirds of canopy
- Redirects regrowth into lower regions of the canopy





## **Mechanical Hedging**

- Can be utilized to make light tipping cuts or more aggressive heavy cuts
- Potential benefits:
  - Reset symptoms of interior defoliation of the canopy
  - Encourage more fruiting wood from cuts made to long spindle growth by creating more shoots
  - Reduced dependence on hand labor
- Does NOT correct structural problems



### **Mechanical Skirting**

- Eliminates the need for costly hand pruning
- Increases harvester efficiency
- Minimizes herbicide contact with canopy





# California Olive Ranch Mechanical Hedging Trials

#### **Questions in Mechanical Hedging**

- How often is it necessary to prune to:
  - Minimize crop loss
  - Maximize the amount of potential fruitful wood for the following year
- What time of year is the most effective to prune mechanically?
- What rotation for practical in field application?
- What severity is optimal to maximize **fruitful** regrowth?
- What type of hedging equipment is most effective?
- What is the interval for regeneration of fruiting wood?



# Initial COR Oroville Ranch Trials

 Initial trials conducted on COR Oroville Ranch 2007-2008



#### Hedging Cuts

- Overview
  - Treatments initiated in the spring and fall
  - Conducted on 8 and 9 year old trees
  - Severe hedging cuts made approximately 6 inches from the central leader
  - Goal of hedging to correct severe structural issues due to 3 years of no pruning
  - No copper applied immediately after the cut





### **Results of Initial Trial**

Results of 07-08 Trial

- Limited regrowth observed
- Large branches cut did not regenerate growth
- Substantial crop loss
- Heavy olive knot infection
- Hedging cuts did not eliminate heavy spurs within canopy

 After this trial a follow up trial was initiated to correct these issues



# Secondary Trial- COR Oroville Ranch

Overview:

- Conducted fall of 2008
- Cut made 20" inches from wire
- Double sided gable cut initiated after hedging
- Copper applied after cuts
  made
- 50% of orchard canopy was hedged

Results:

- Better regrowth and regeneration of canopy
- Substantially better re crop than prior treatments although crop was still severely reduced in year of hedging
- Less olive knot observed following post treatment copper application







# Conclusions Following COR Oroville Initial Trials

After the initial trials in Oroville the following conclusions were made:

- Less severe cut provides better recovery for the canopy
- Copper application is recommended after hedging
- Hedging application does not fully correct structural problems
- Regrowth is limited from cuts to larger wood





## Heavy Spurs Left by Hedging Cuts





# Vegetative Growth Spurred by Hedging Cuts





# COR Artois Mechanical Four Year Mechanical Pruning Trial

- Following the initial trials conducted in Oroville a formal trial was initiated in 2009 at the COR Artois Ranch
- Trial conducted in conjunction with UC Cooperative Extension and CSU, Chico
- To be conducted 2009-2013





# Goals of Mechanical Hedging Trial

- Hedge 25% of the canopy per year
- Test the effectiveness of a single sided treatment and a double sided treatment from each other and the control (COR hand pruning program)
- Determine the optimum distance from the central leader in which to make the hedging cut
- Determine the effect on yield of hedging treatments versus the control (COR hand pruning program)
- Determine a practical in field application for commercial use



# COR Artois Hedging Trial Treatments

#### **Orange Treatment:**

- 4 tree rows per treatment, 4 treatments total
- 25% of total orchard canopy in treatment pruned each year
- Alternating between hedging eastern and western face of the canopy each year
- Both sides of a orchard tree row are never hedged within the same year

#### Pink Treatment:

- 4 tree rows per treatment, 4 treatments total
- 25% of total set canopy in set pruned each year
- Both east and west sides of canopy of one complete tree row in treatment set hedged in each year

#### **Control Treatment: COR Hand Pruning Program**

- 4 tree rows per treatment, 4 treatments total
- Trees hand pruned in traditional style each year, 6 labor hours per acre.
- Two large cuts made to remove dominant lateral branches coming directly into tree row
- Cuts are made to remove dominant laterals that inhibit the ability of the mechanical harvesters to gain maximum fruit removal and also create wounds that provide infection points for the olive knot bacterium

#### Hedging Cut 20" from Leader





#### **Orange Treatment**



THE NEW TASTE OF FRESH\*

#### **Pink Treatment**

#### **Treatment Diagram**





# Yield Comparison 2010-2011

- Weather events in 2009 and 2010 led to overall crop reductions in the block
- Reductions in overall alternate bearing observed in both hedging treatments versus the control hand pruning treatment
- Important to note that this is only two years of data into a four year trial

	Tons/acre		% Change	Tons/Ac. 2010+2011
	2010	2011		
Orange Treatment	3.23	2.47	23%	5.70
Pink Treatment	3.16	2.18	31%	5.35
Control	3.24	1.83	43%	5.07



#### Yield Comparison 2010-2011





#### **Canopy Density**

#### Canopy Diameter July 2010 vs. September 2010



Measured Sep 22, 2010

Measured July 10, 2010



### Net Return per Acre

Treatment	Cummulative	Cost Difference	Gallons/Acre	Net Difference	Net Return/Acre (when
	Tons/Acre	per Acre*		Gal/Ac**	compared to Control)
Orange Treatment	5.70	-\$66.00	210.90	23.31	\$326.34
Pink Treatment	5.35	-\$66.00	197.95	10.36	\$145.04
Control	5.07	-	187.59	-	-
* Hand Prune \$80/ac; Mechan					
<b>**</b> Difference between given treatment and control					
**Assumes a \$14 Grower Payr					



# **Hedging Application**

- Preliminary data from COR Artois Hedging trials indicate:
  - 10-14" inches of re growth on the same respective treatments
  - Increased light penetration and fruit sizing
  - Increased harvest efficiency and fruit removal
  - Balanced regrowth on the single side method
  - Reduction in alternate bearing
  - Does not correct structural tree issues
- Goal to find a practical application while heading 25%-30% of canopy face per year
- COR is currently applying a three year rotation hedging trial across 1500 acres of the Artois ranch to test the commercial feasibility of the hedging rotation



## **Commercial Hedging**





Commercial Hedging Rotation at California Olive Ranch



East Side of Block



#### **Cost Analysis**

- Typical pruning in Super High Density requires between 6-8 labor hours per acre or \$80-\$100 Dollars per acre
- Commercial Mechanical Hedging has reduced cost to approximately \$14 per acre for grower owned and operated equipment
- This cost includes fuel, labor, and machine depreciation
- This is at a 25% to 30% canopy reduction per year





# **Further Questions**

- What time of year is optimal for hedging to minimize olive knot infection while maximizing regrowth?
- How severe should the cuts be in terms of distance from trellis wire?
- How much time will be required for regrowth to become fruitful?
- Will Hedging create excessive vegetative growth?
- What is the proper interval between hedging cuts? (How many years between cuts?)
- Will the reduction in canopy volume from hedging reduce long term crop yield?
- How frequently will hand pruning be necessary to remove large spurs and correct structural issues?
- What piece of equipment will be most effective in commercial scale hedging?



### Concepts for the Future



#### Mechanized "tipping" for young trees

