Fruticultura de avanzada
Mechanization of apple and pear Orchards

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APPLIES

The healthy snack.

No cholesterol.

High in fiber and potassium.

Low in sodium and fat.

Source of vitamins and minerals.

Only 85 calories.
We need to sell and attractive fruit to the market:
The robots, near future:

But, tu work with robots in an orchard, the trees need to be perfect, all senses.
Wa, USA situation:

• 10 years ago, the idea was use 20% less labor in orchards.
• Today ( from last year 2014.. ), all the research and work is how to use 80% less labor.
• 80% less from 1,000 hour /ha.
First question:

• Why we need to mechanize?
Answer:

• No labor, or
• Not enough labor, or
• Not enough good labor, or
• Too expensive labor.
Second question:

• My orchard is ready for full mechanization?
Answer:

• It depend.
• Easy to modify the orchard (row distance, tree architecture, tree height), than a machine.
• Many countries in front, ahead, Italy in special....
## Aspect to be covered today by mechanization in «Old fashion orchards»

- Spraying products to the canopy.
- Spraying products to the trunk.
- Spraying herbicides.
- Mulching the grass.
- Mulching the pruning wood.
- Moving the bins.
- Recovering the industrial class fruit.
Aspect to be covered by mechanization in « modern ( thin ) orchard»

- Pre pruning. **Toping, lower parts, chape.**
- Mechanical thinners ( flowers ). **Darwin, Bonner, hand held devices, others**
- Summer pruning. **Multiple sides blades.**
- Spraying products to the canopy. **Low volume, multiple rows, tunnels, solution recover, higher speed, less drift, faster dry...**
Aspect to be covered by mechanization in « modern ( thin ) orchard »

- Spraying products to the trunk.
- Spraying herbicides.
- Mulching the grass. *Multiple blades machines, different angles work, berms.*
- Mulching the pruning wood.
- Flat platform uses.
- Modern platform ( arms, sensors.. )
Aspect to be covered by mechanization in « modern ( thin ) orchard »

- Future robots: fruit counting, flowers pollination, fruit harvesting and handlings, etc
- Moving the bins.
- Recovering the industrial class fruit.
Third question:

• What’s are the most limiting factor for to introduce the mechanization in an orchard?
Answer:

• The tree design.
• The tree development.
• The between row distance.
• Pendent of the soil (long + lat).
• The money availability (pockets, bank, export companies...)
• Other factors..
Four question:

• What means a « modern design » « orchard » ?
Answer:

• One, where the rows are close, the axes or trees are closer on the row, where the tree is simple (ideally, structured on wires...), the genetic is fantastic, the fruit uniformity is perfect.

• Dreaming ???????
SNAP (USA definition)

- Simple
- Narrow
- Accessible
- Productive
A narrow canopy block:

• Easy access.
• Uniform maturity inside and outside the tree.
• Uniform maturity at the upper and down part of the canopy.
• Uniform maturity on two faces of the tree.
• Harvest close to one pass...
Evolution on a training system

( Craig Hornblow )

• We need around 35 km of good productive wood for 80 tons /ha.
• 1 fruit every 10 cm (350,000 size 80)
PHOTOSINTESIS: the simple ecuation

\[ \text{CO}_2 + \text{H}_2\text{O} \xrightarrow{\text{Luz}} \text{CH}_2\text{O} + \text{O}_2 + \text{Energía} \]
Light interception

carbohydrate partitioning

Forest trees

Fruit trees
Light Interception: it is very important
Relation between LI and production on different apple varieties and clones, J. Wünsche et al.

![Graph showing the relation between LI and production on different apple varieties and clones.](image-url)
Ligth penetration: porosity
Tree shape ?
Tree wide (diameter)?
• Las plantas pueden ser piramidales o cilíndricas.
• Por ningún motivo deformes (viento, estructura).
• El radio máximo no debe superar los 0,7 metros.
How deep the canopy need to be?:
60 a 70 cm
Higher trees?
Higher trees?

- Base of platform can go up around 2.4 m.
- A person can work until 1.7 to 2.0 m high.
- Maximum combined high, 4.4 m.
Distance over the row?
Distance over the row?
Closer trees...:

- Smaller trees, smaller canopies.
- Weaker branch formation.
- Open angles.
Tree distance and canopy development:

4,0 x 1,2 m, Brookfield / MM 111

4,0 x 1,0 m, Brookfield / MM 111

4,0 x 0,5 m, Brookfield / MM 111