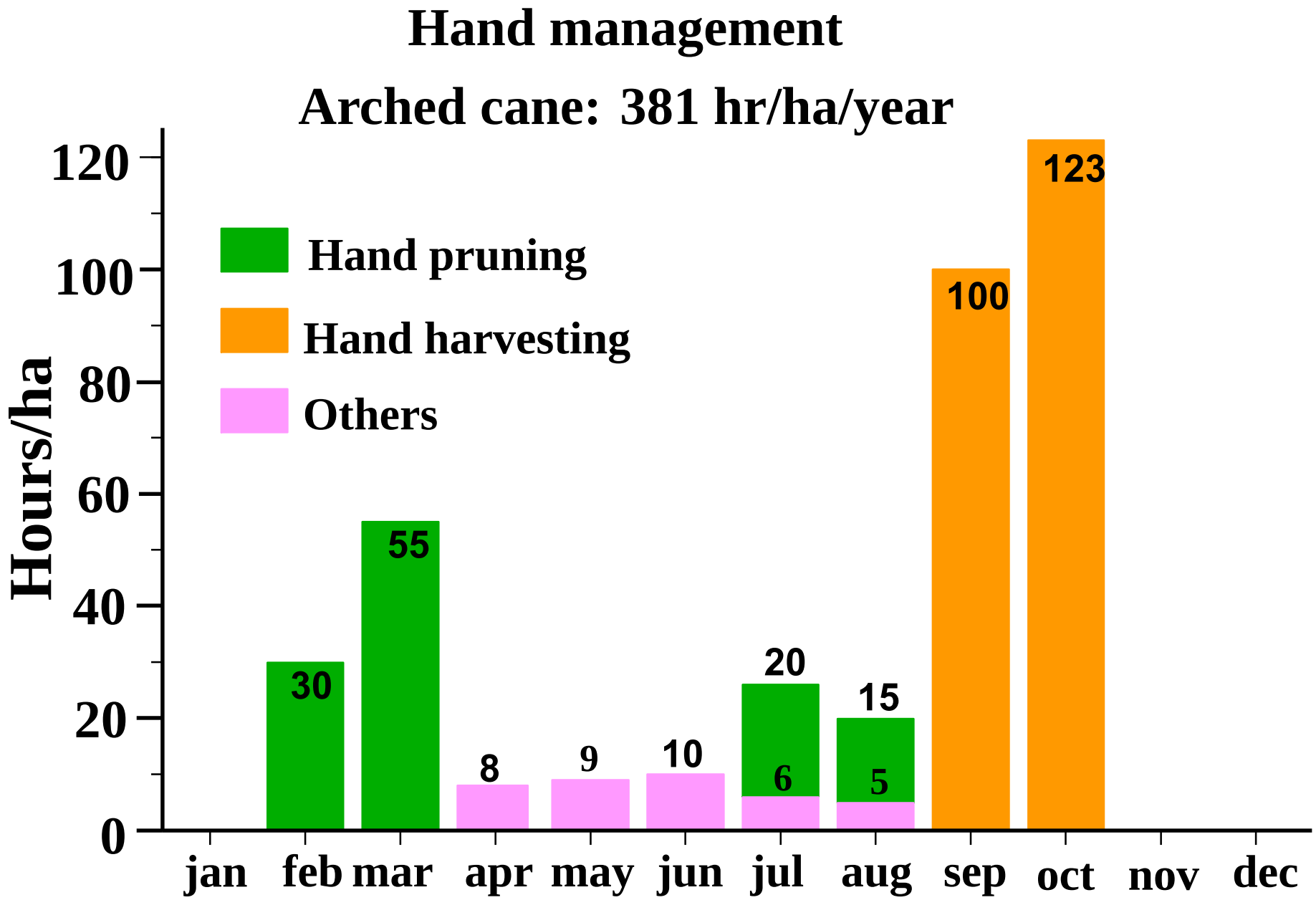
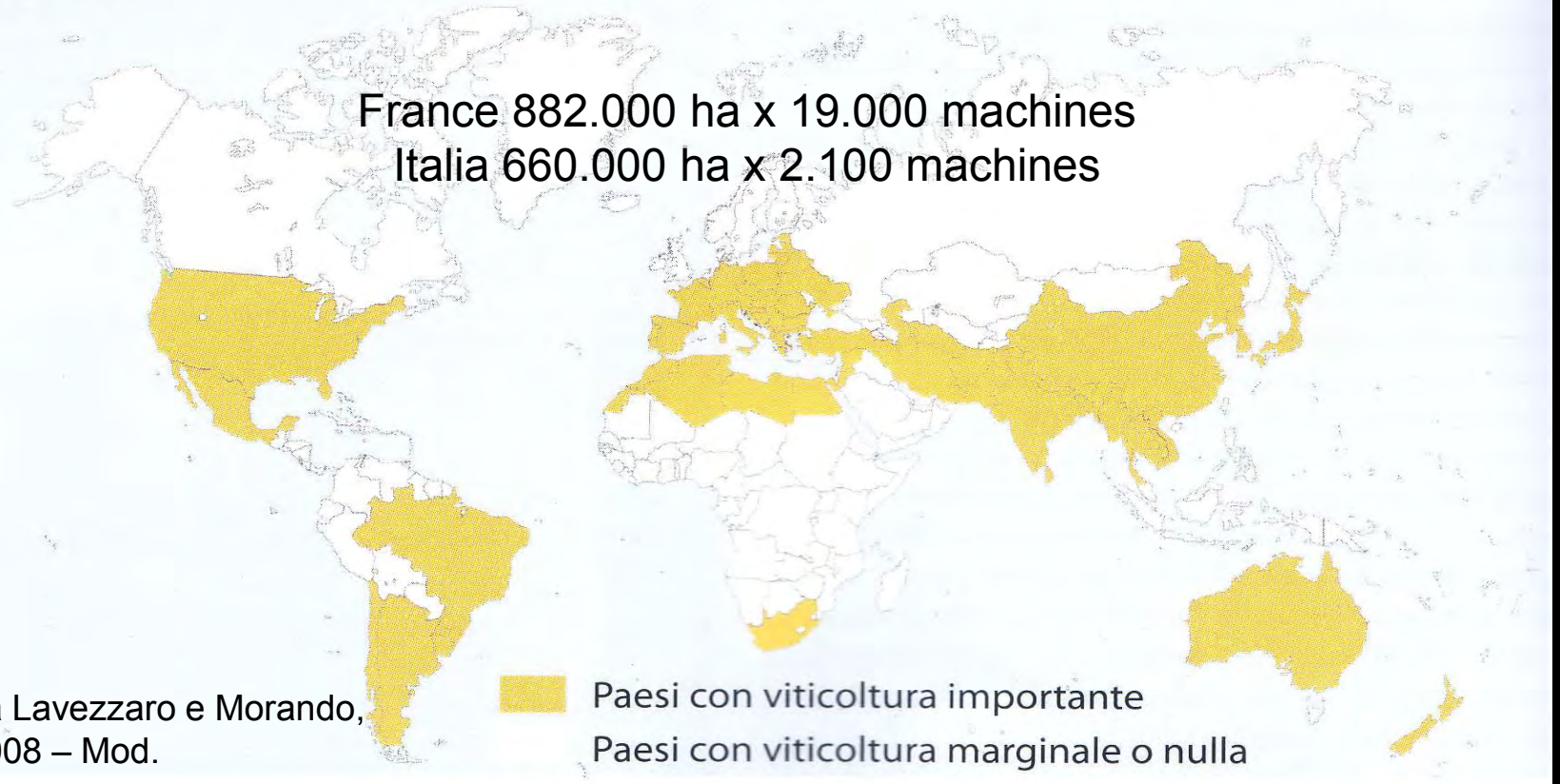
# Mechanical harvesting


Hand management
Arched cane: 381 hr/ha/year
Hours/ha
120
100
80
60
40
20
0
Hand pruning
Hand harvesting
Others
30
55
8
9
10
20
6
15
5
100
123
jan
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec

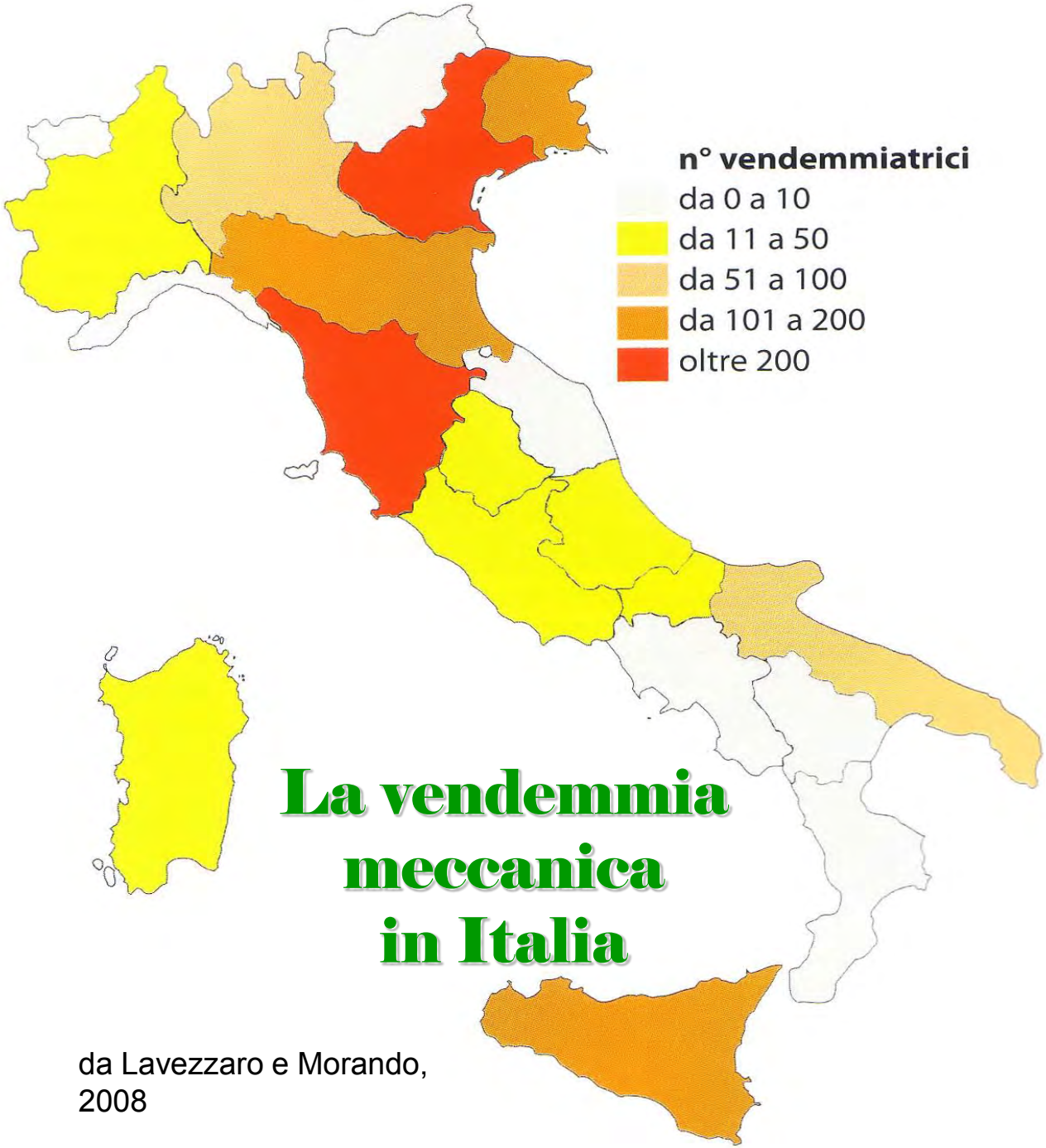
# Mechanical harvesting in the world

| Stato | Superficie vitata (x 1000 ha) | Vendemmia meccanica (%) | Stato | Superficie vitata (x 1000 ha) | Vendemmia meccanica (%) |
|---|---|---|---|---|---|
| Spagna | 1.174 | 11 | Argentina | 210 | 3 |
| Francia | 882 | 68 | Nord America | 190 | 50 |
| Italia | 760 | 12 | Cile | 150 | 20 |
| Portogallo | 246 | 10 | Australia | 140 | 75 |
| Germania | 102 | 73 | Nuova Zelanda | 25 | 75 |
| Est Europa | 1.324 | 1 | Sud Africa | 104 | 19 |

France 882.000 ha x 19.000 machines
Italia 660.000 ha x 2.100 machines




da Lavezzaro e Morando, 2008 – Mod.




# La vendemmia meccanica in Italia

da Lavezzaro e Morando, 2008

Slow process in Italy:
- Training systems
- Inadequate materials
- Small plots
- Skepticism…..

Why the machine?
- Cost reduction
- No more nned for difficulti to find and expensive human labor
- Timeliness in harvesting.
- Precision harvesting?

# Vineyard design

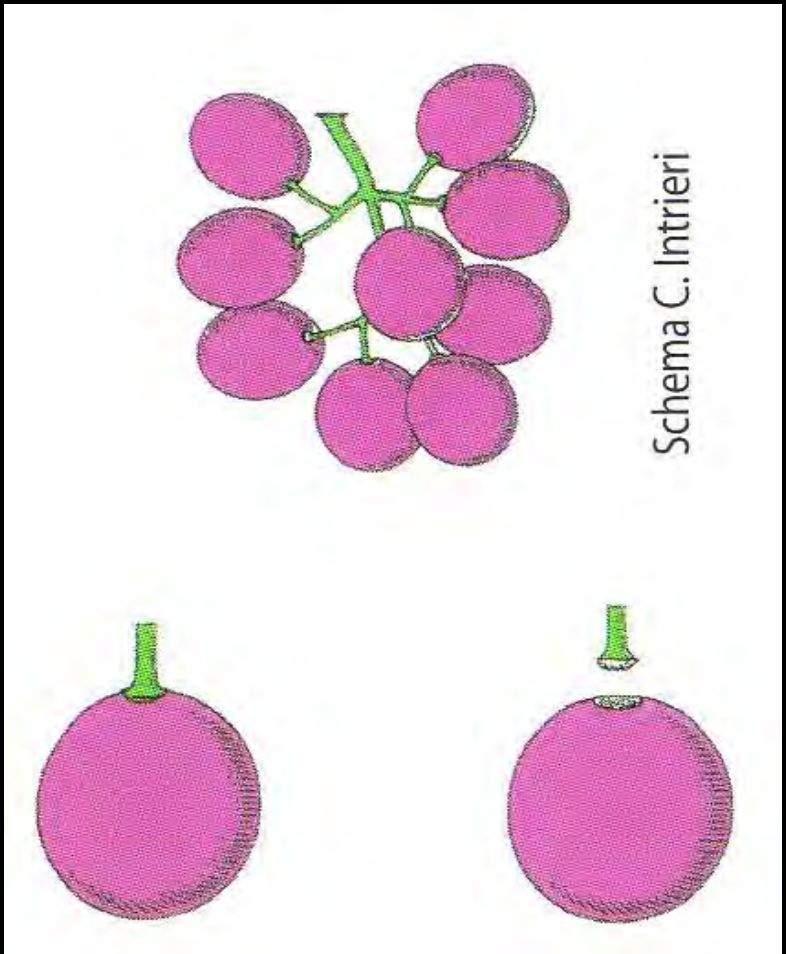
- Trellis geometry and pruning
- Row length
- Soil slope
- Wide turn-around area
- Floor management
- Easy vineyard access


2000/2 TA

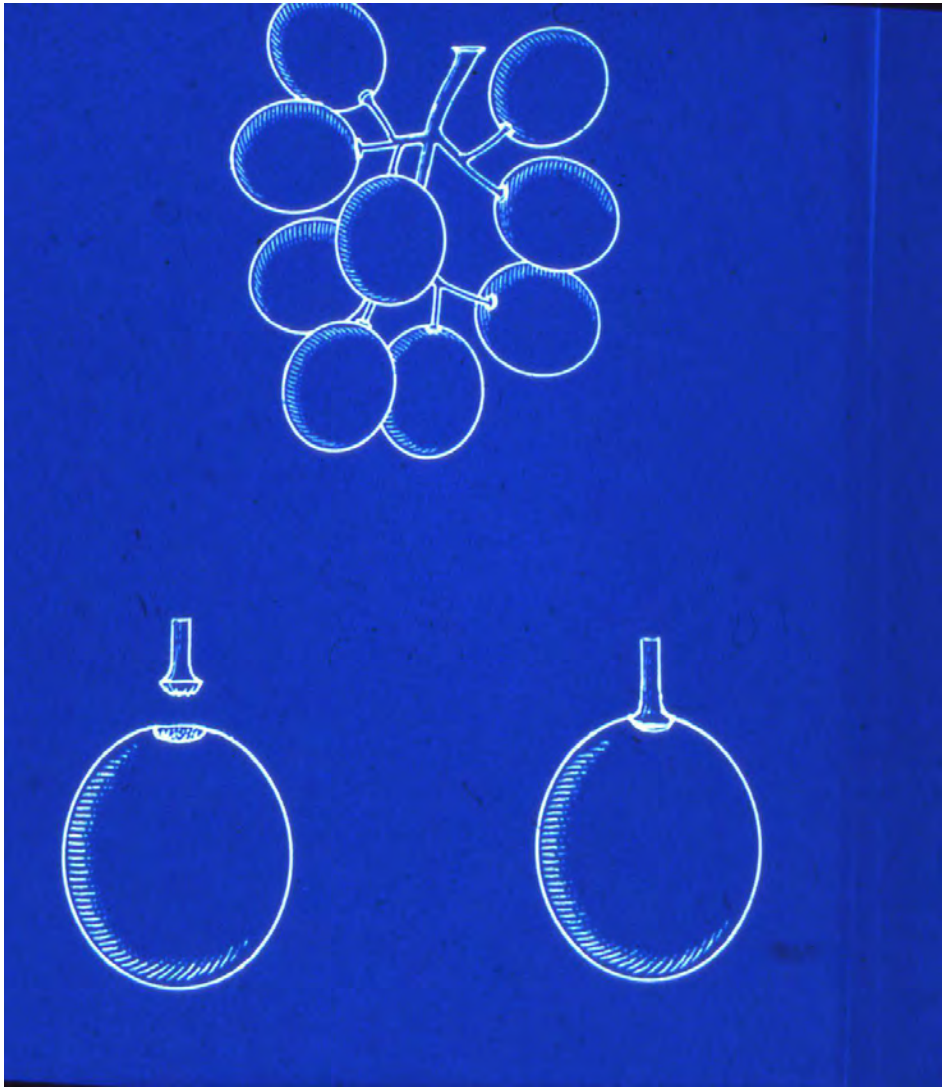
# Why berries detach from the rachis?

- Berries detach when subjected to a kinetic force higher that the detachmnet force from the pedicel.
- The kinetic force is proportional to acceleration and berry mass
- Deatching less ripen berriw requires higher acceleration.
- During the machine passage, the trellis tipically «shakes» according to two different principles:

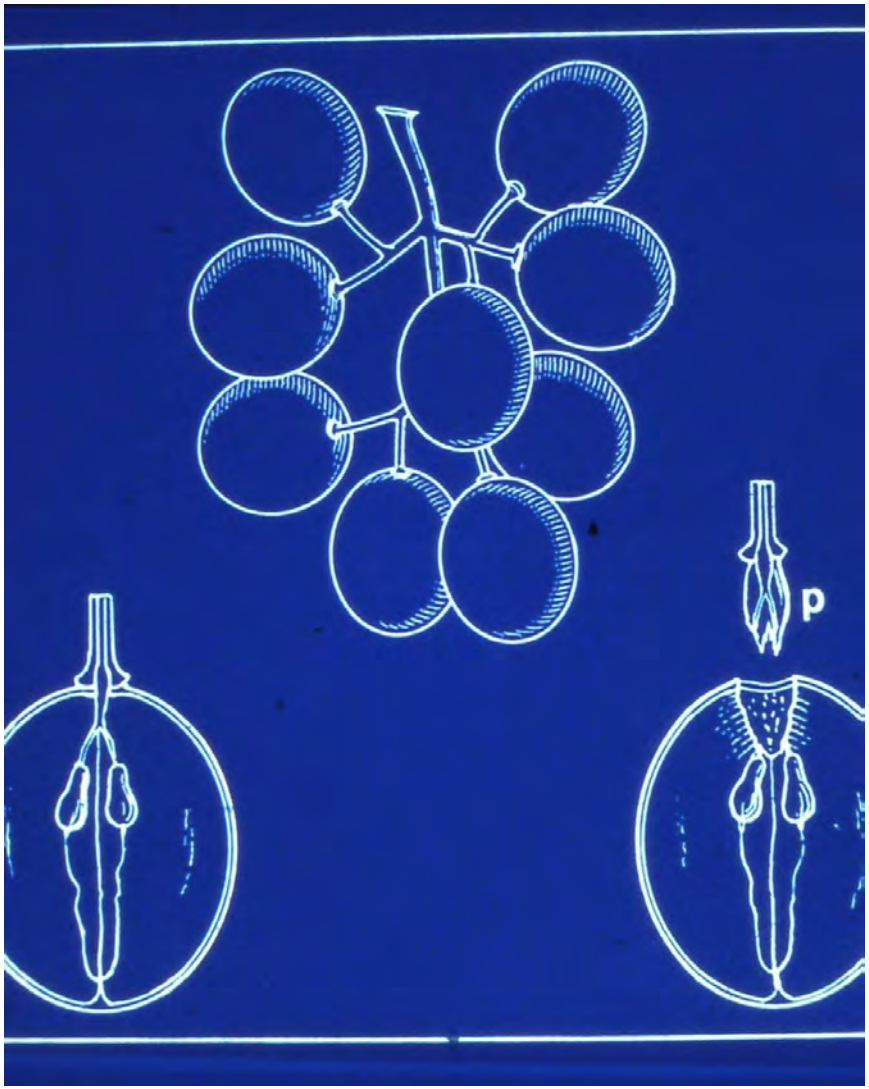
  - **Vertical shaking**
  - **Horizontal shaking**

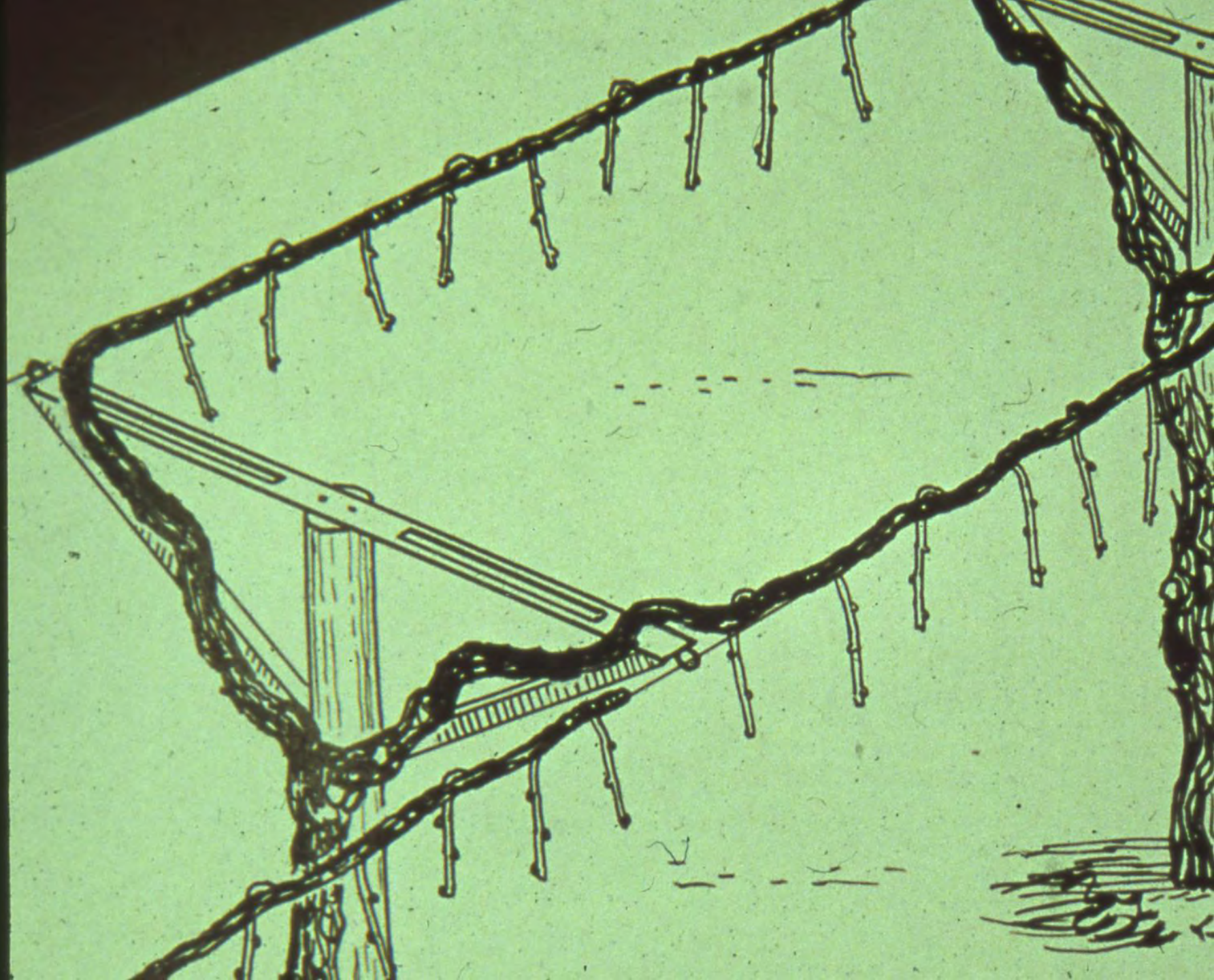


# Vitis labrusca



# Vitis vinifera L.





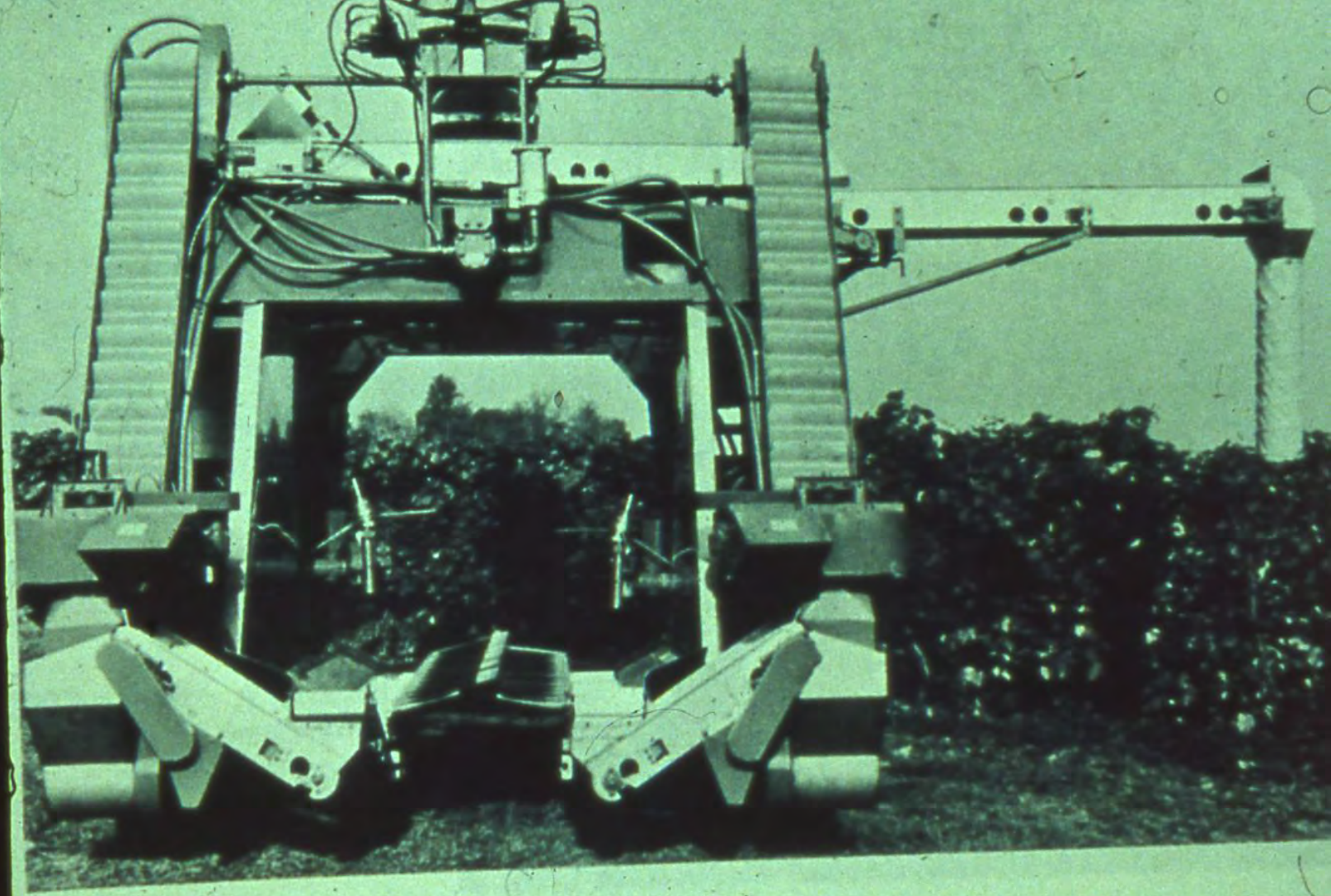
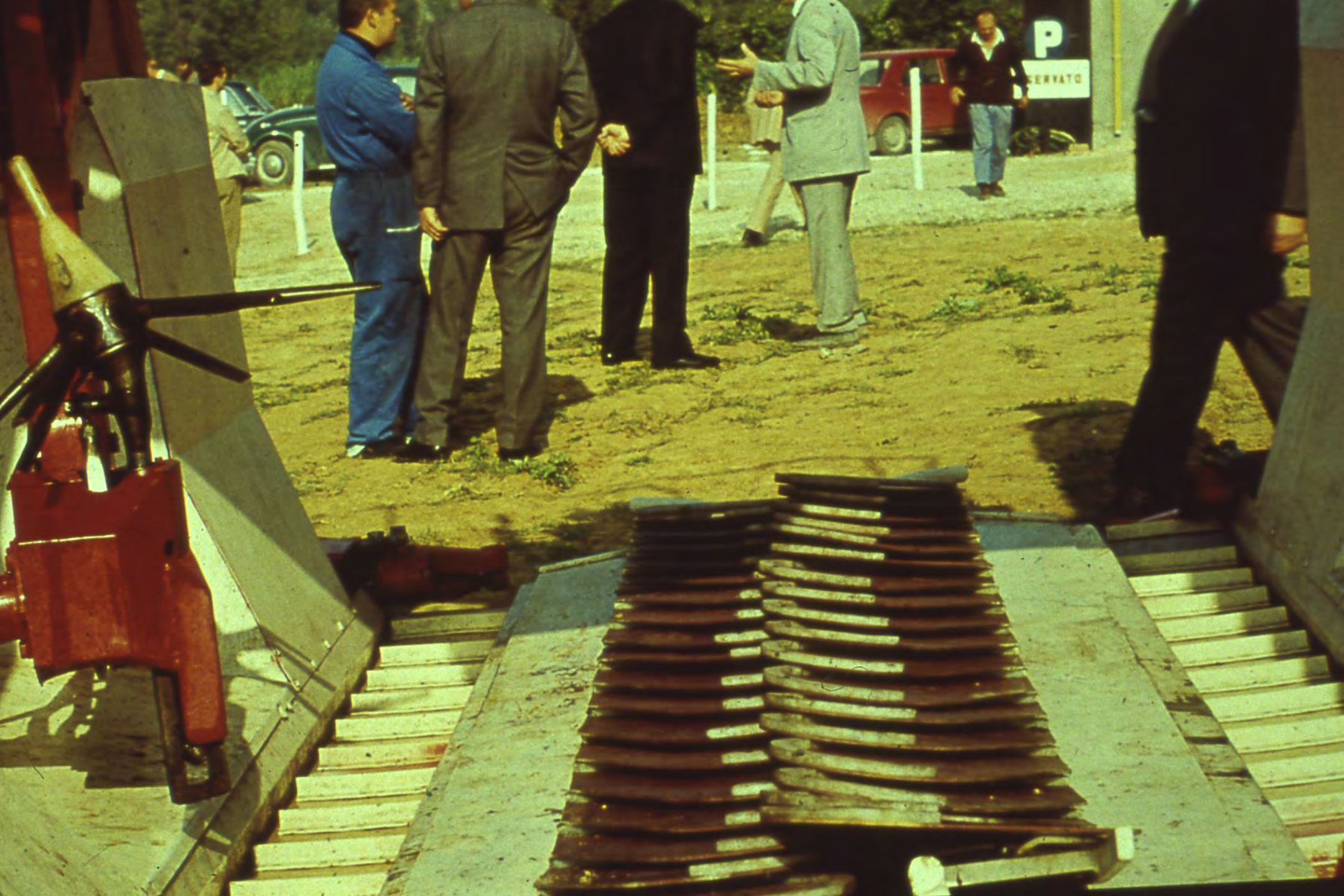
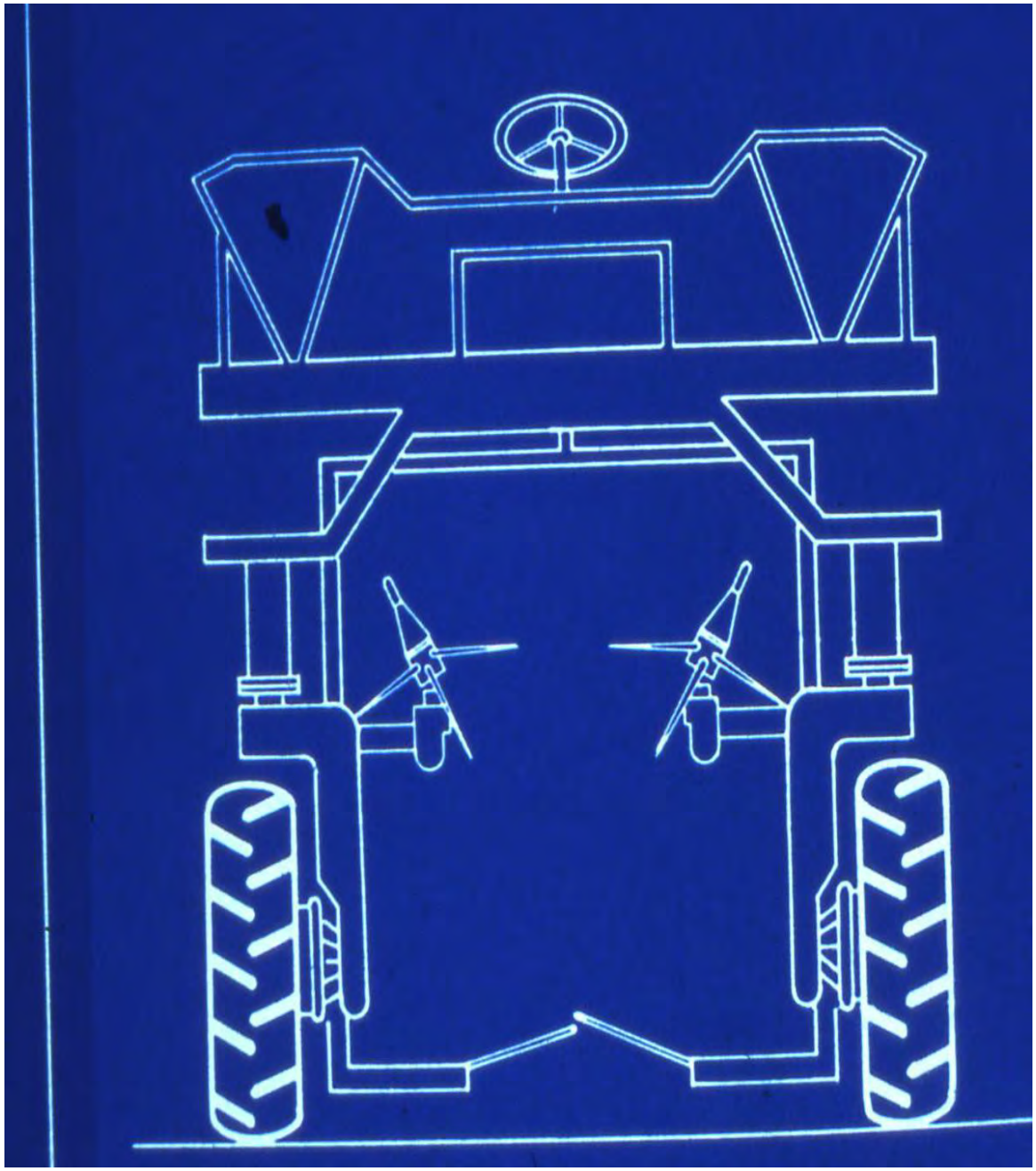
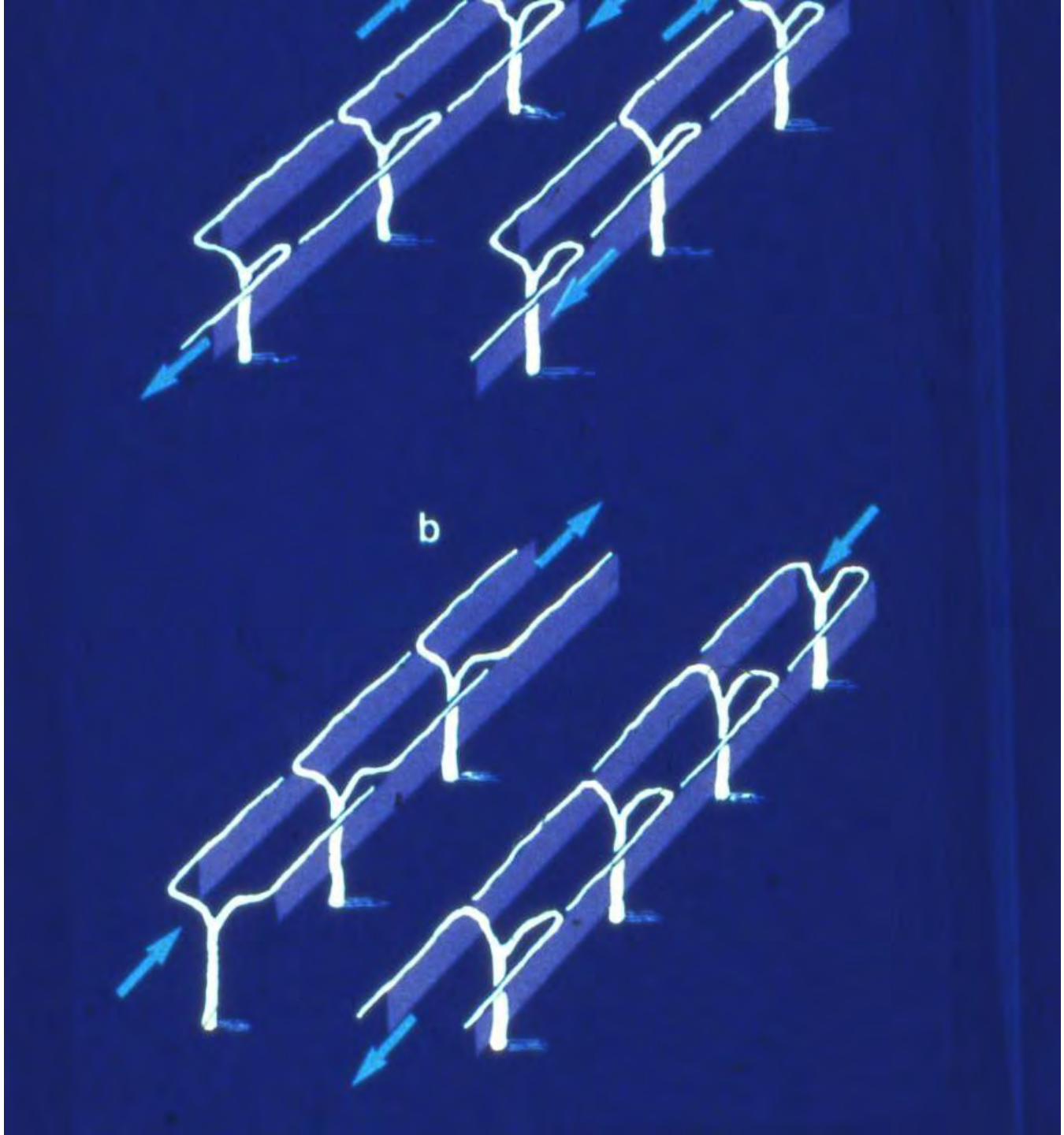


Figure 11. CRCO 1968 production model, showing spiked wheel shakers, flexible leaf collectors, cleaning fan, elevator and conveyor


P
CENVATO

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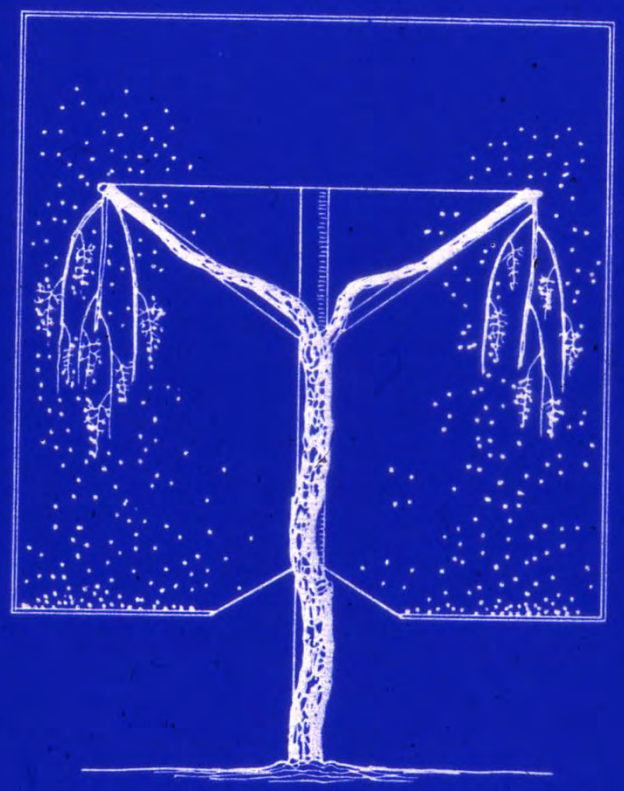
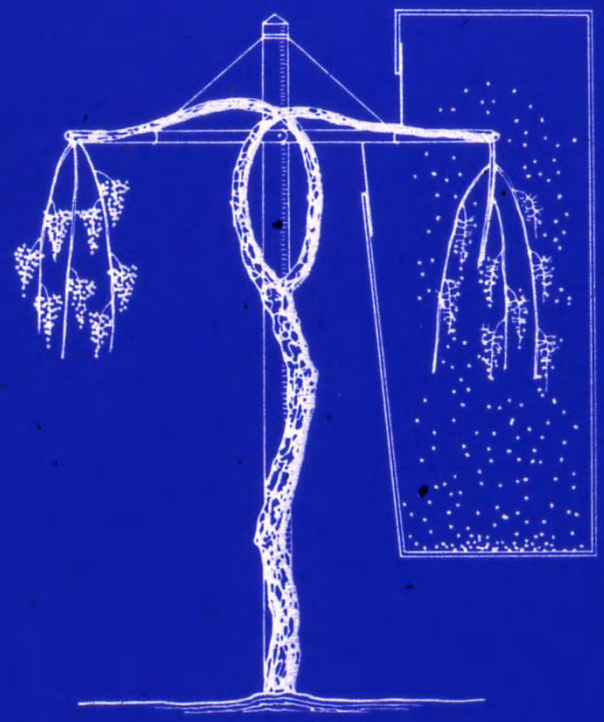
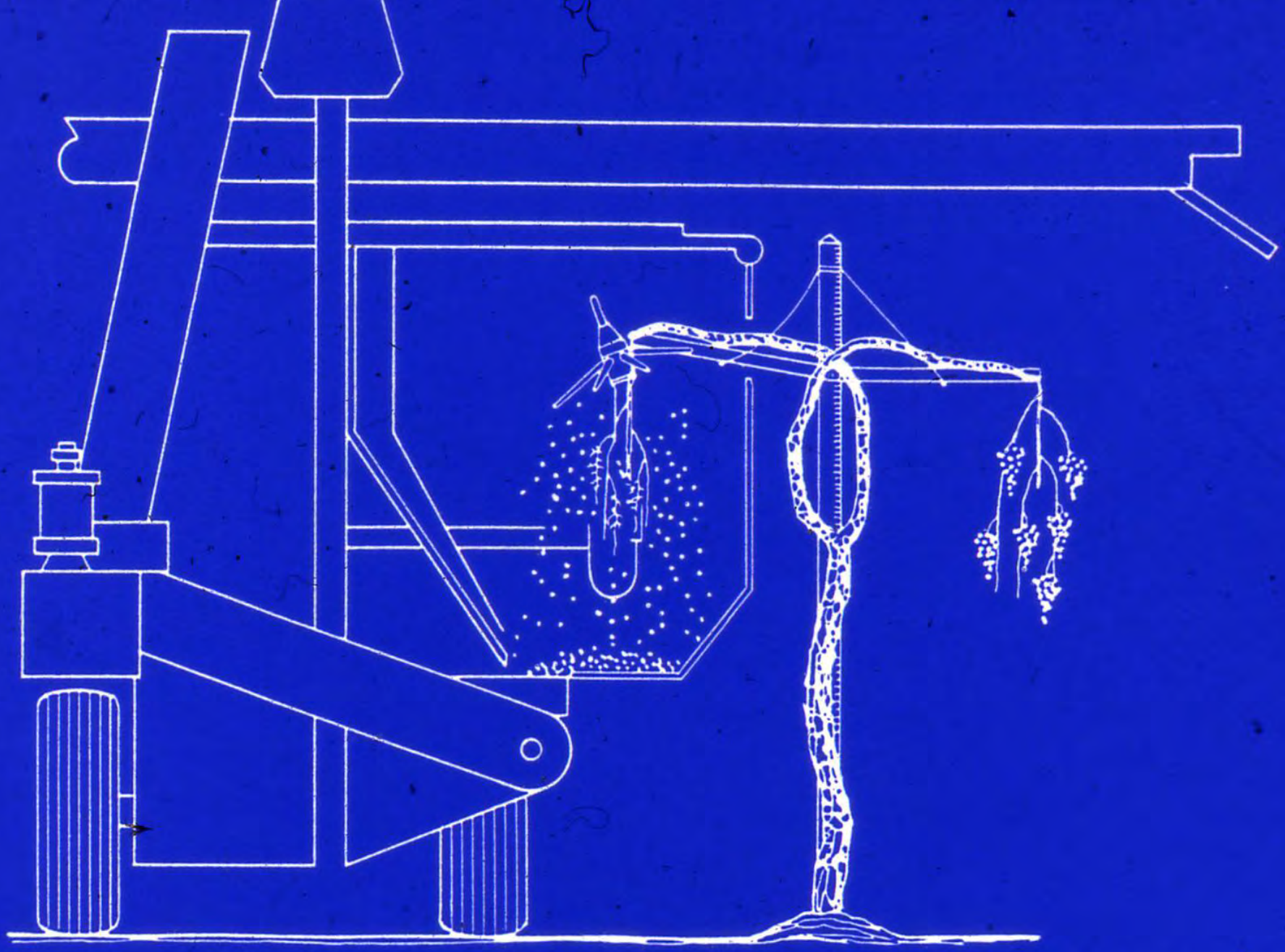
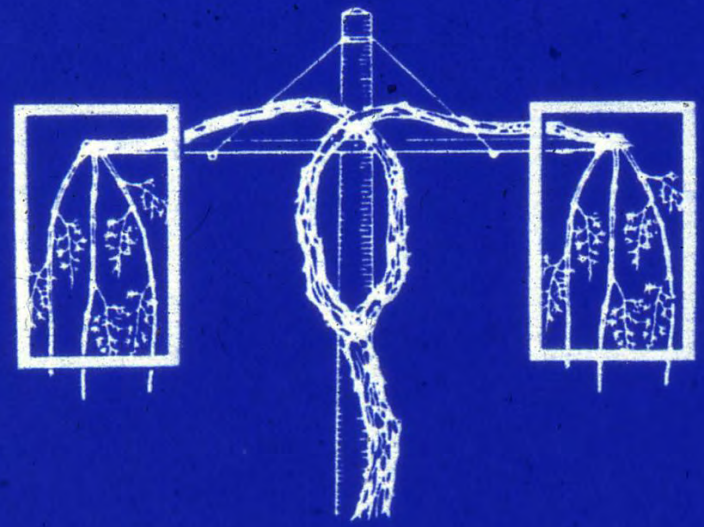
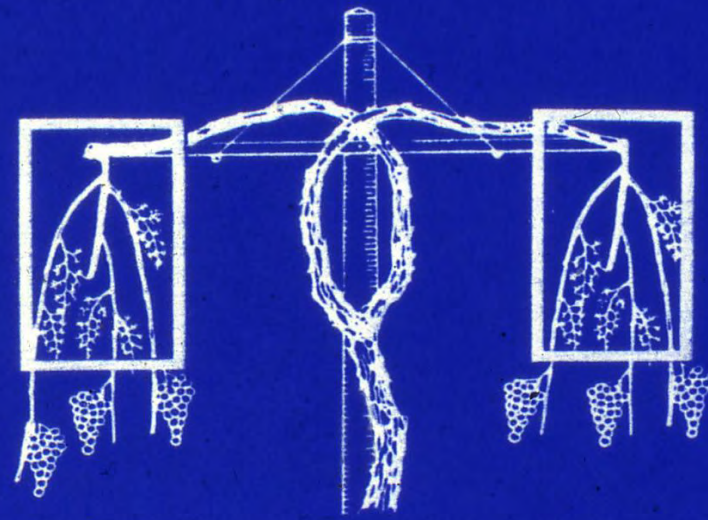
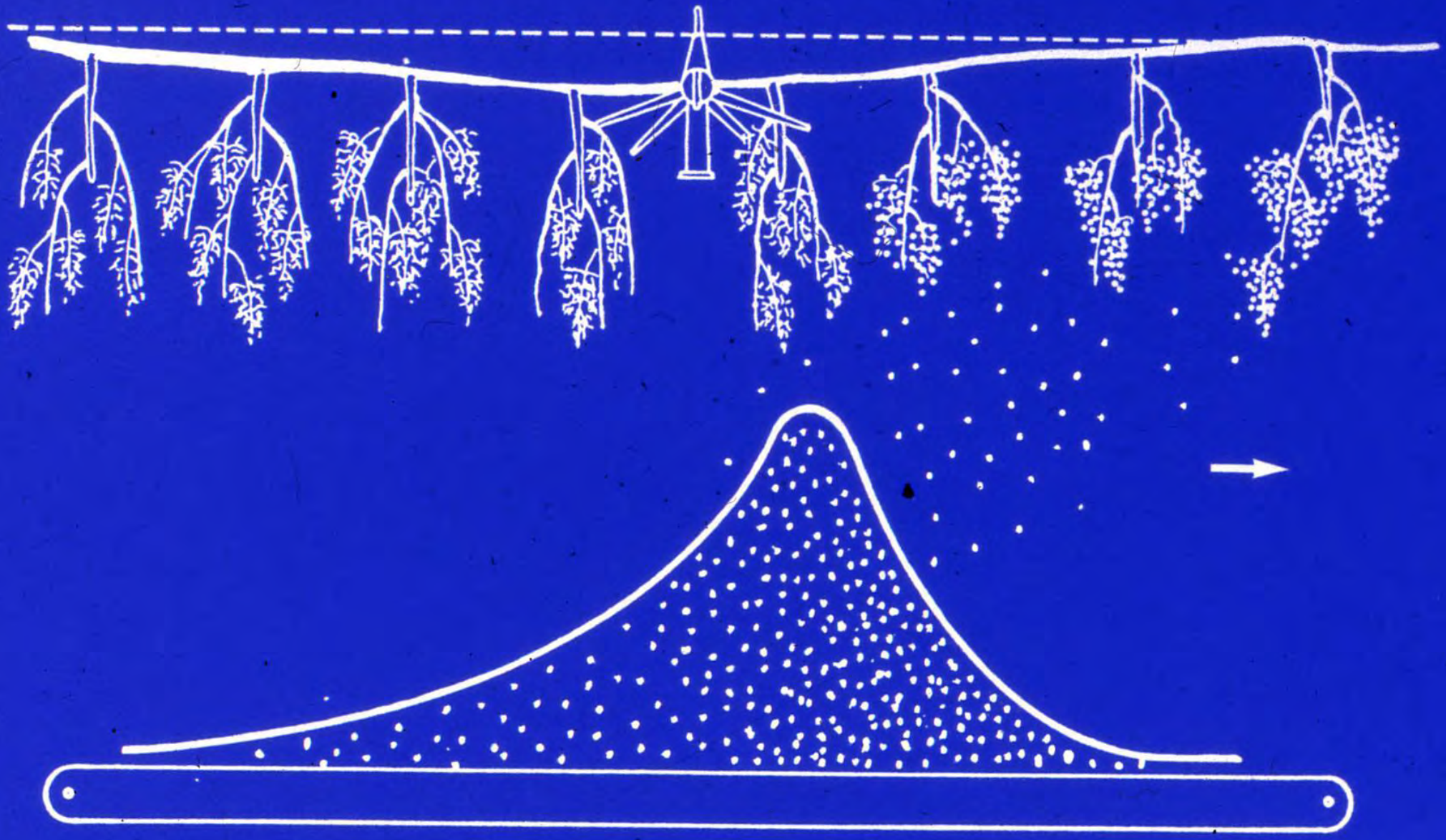












# Horizontal shaking


Over-row machines
Horizontal slappers inside the tunnel
The row «vibrates».

# Self-propelled vs dragged or mounted

Pro:

- High speed (up to 5 - 6 Km/h)
- High efficiency: 0.5 0.8 ha/h
- Easy to move
- Multitasking

Cons.

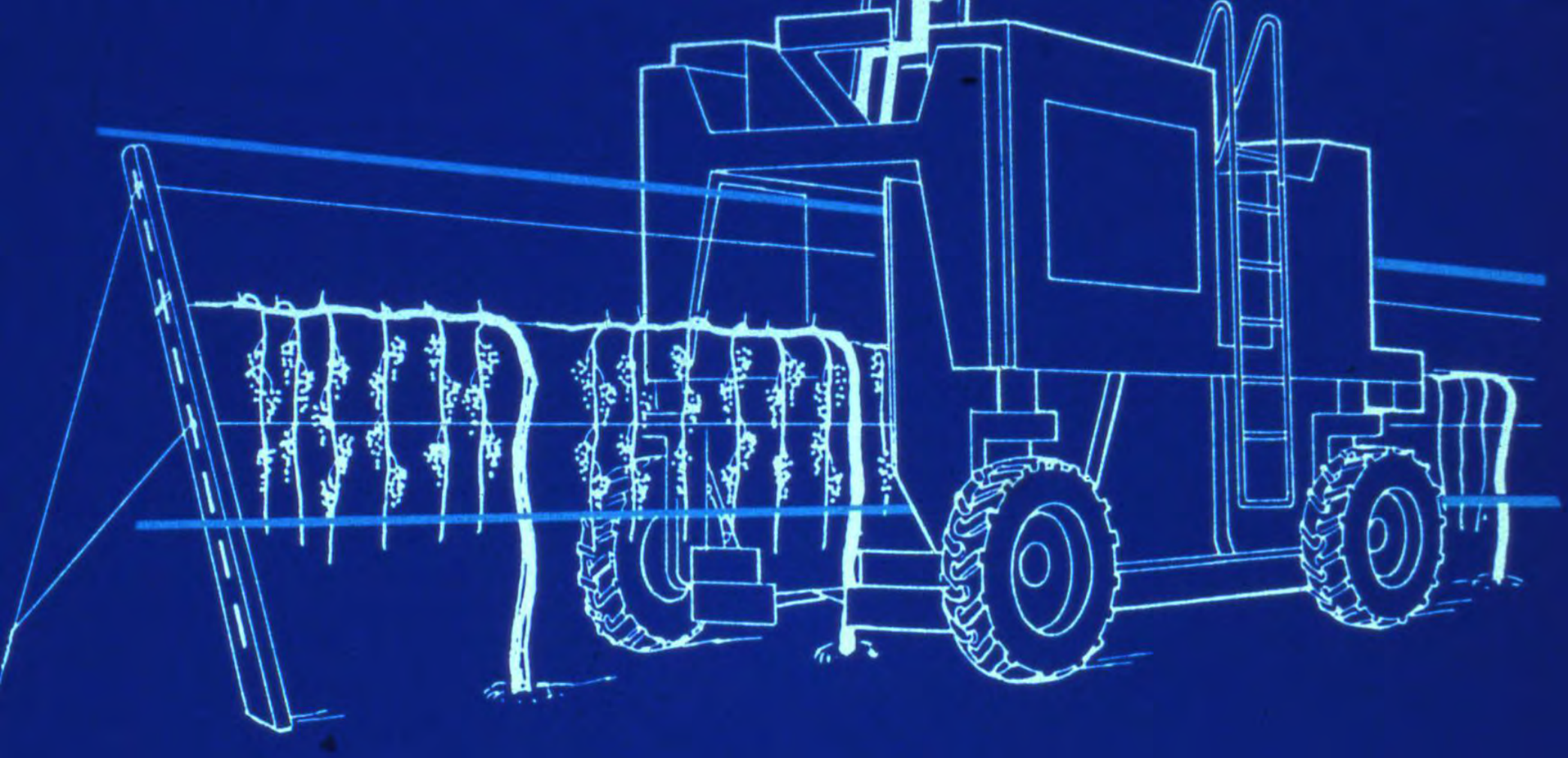
- High purchasing and maintenance costs
- Heavy


Pro:

- Good for very steep slopes
- Light weight
- Lower costs

- Cons:
- Low speed (up to 2 km/h)
- Medium effiiciency: 0.25 0.35 ha/h

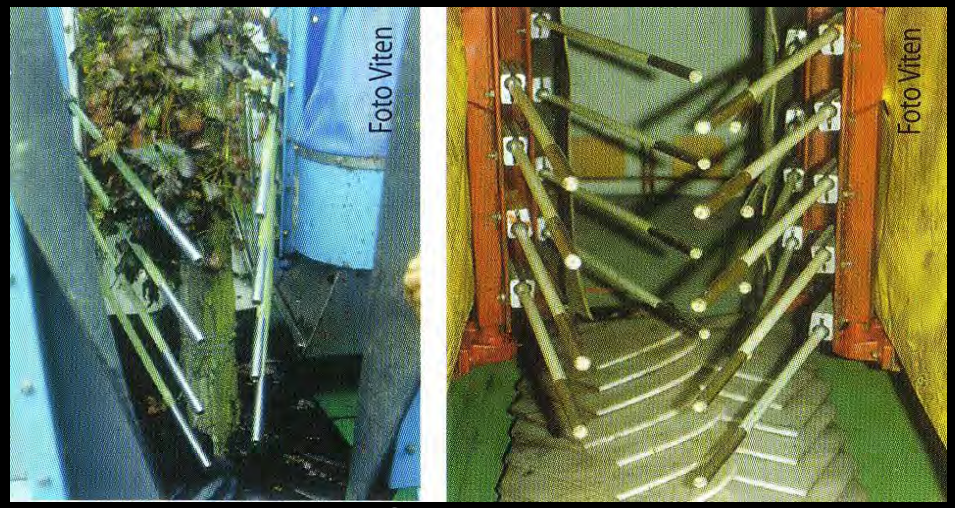

BAUSCH·MERTEN



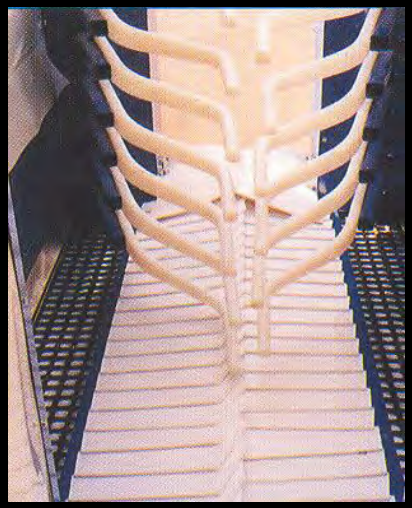
*55 - La «luce libera» sotto il ponte delle emmiatrici scavallatrici condiziona l'altezza ima fuori-terra dei pali che non dovrebbe superare i 240 cm. Solo con alcuni modelli tale altezza può raggiungere i 260 cm, grazie al sollevamento del telaio sulle quattro ruote.*

Vendemmiatrici a scuotimento orizzontale costituite da telai scavallatori di tipo trainato.

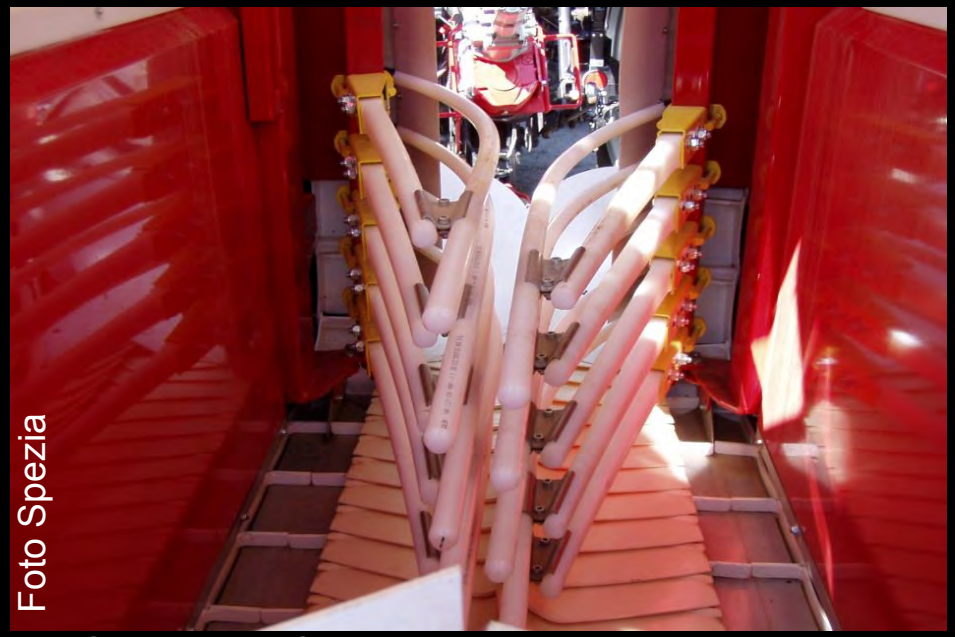
# Slappers evolution




Aste rettilinee in fibra di vetro con puntale rivestito in acciaio inox



Scuotitori sagomati per avere zona attiva di contatto maggiore (Volentieri)

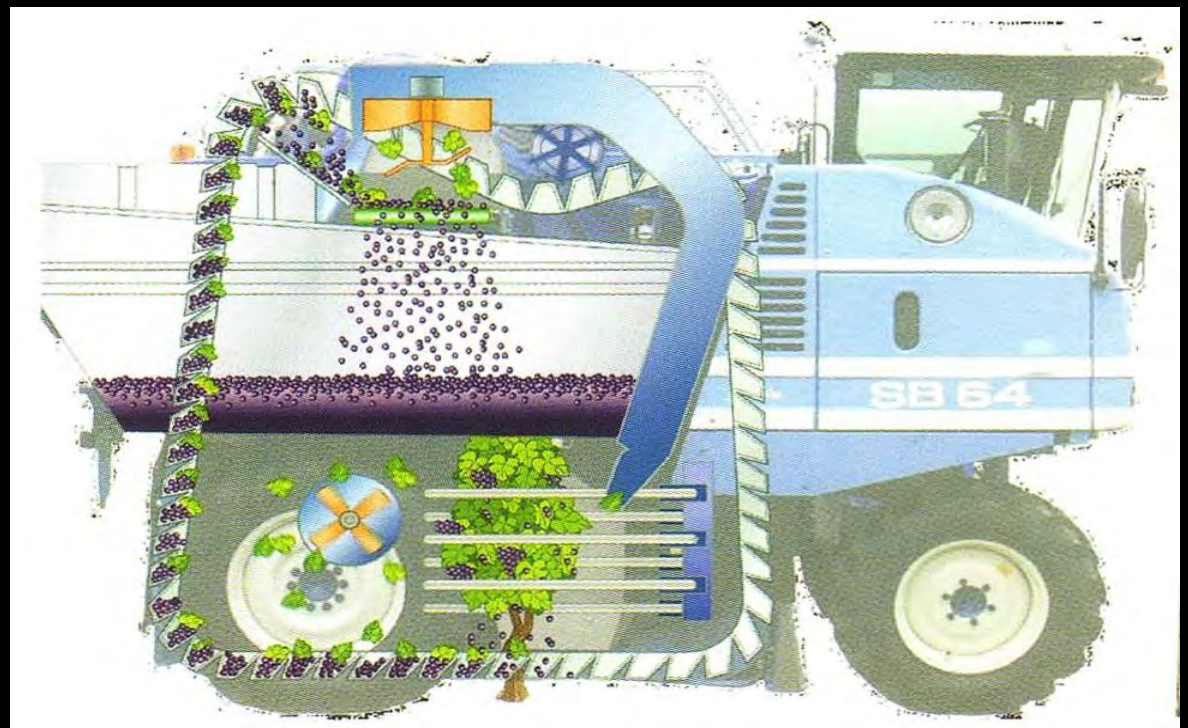



Scuotitori frenati con asta supplementare esterna (Alma)

Sistema frenato Gregoire: gli scuotitori sono ripiegati indietro

# Interception and transport

- Baskets or flakes made of food-compatible materials
- Bottom opening
- Conveyor belts
  - Cleaning – Tanks
  - Trailer running in adjacent row



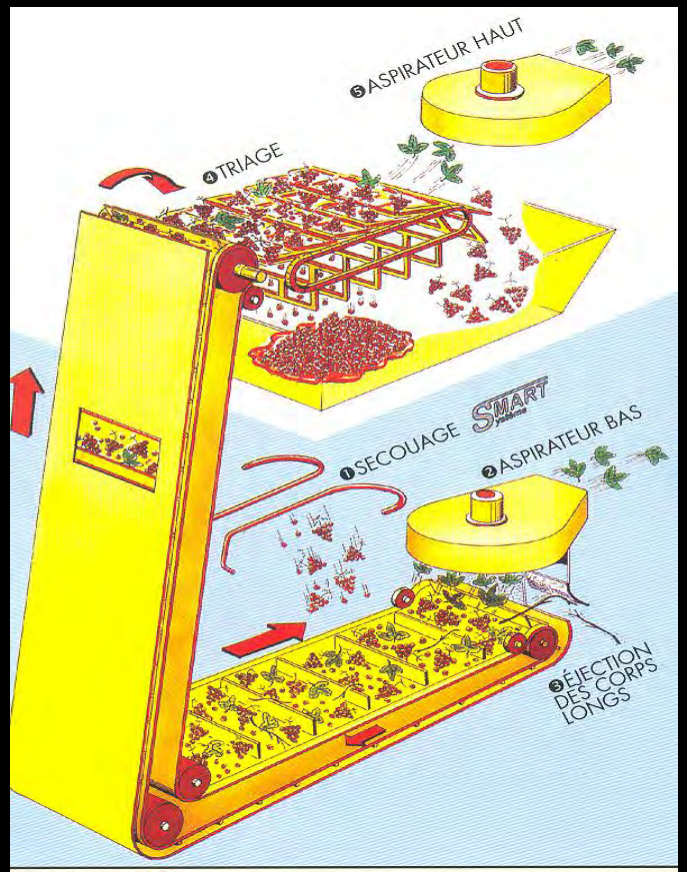
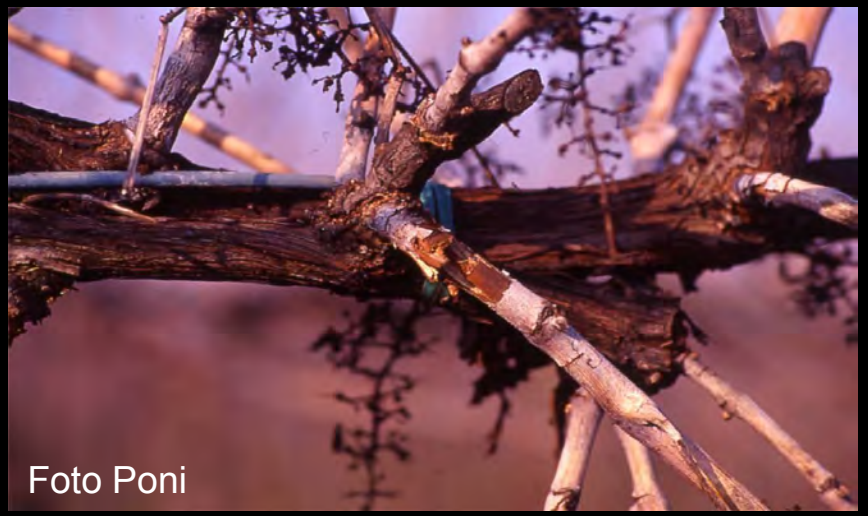



Foto Spezia

# Effects of mechanical harveting on vines

| Cause | Effects |
|---|---|
| Pre-harvest trimming | Removal of younger leaves |
| | Possible reduction in storage |
| Shaking | Cane breakage |
| | Bud damage |
| | Lower yield? |
| | Xylem embolism |
| | Leaf dehydration upon machihne shaking |
| | Diseases? |

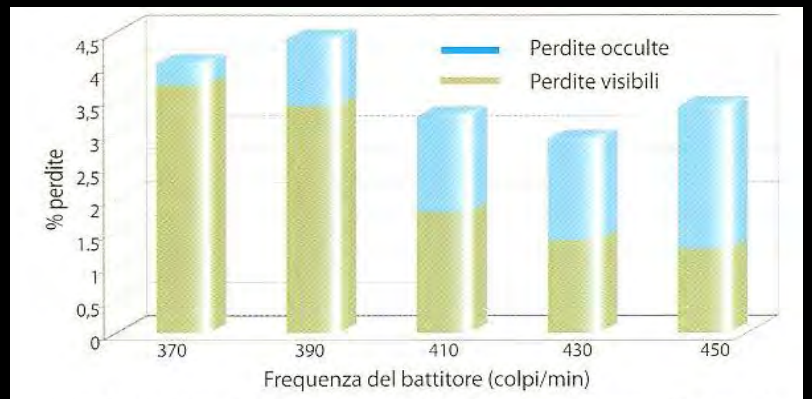

da Gatti e Poni, 2007

# Effects on grapes

- Effects on vineyard
  - Post breakage and/or damage
  - M.O.G.
  - Wires and accessories spoilage
- Effects on grapes
  - Liquid must (5-35%)
  - Oxidation
  - Anomalous fermentation
  - Early maceration
  - Grassy and astringent

Type of losses

- On the ground (2-3%)
- On the vine
  - Failure of detachment
- Hidden losses
  - Must on vegetation or vaporised by blowers.




(D) - La frequenza di battitura ha sulle perdite visibili e su quelle occulte un effetto contrastante. Pertanto è necessario individuare la velocità in cui viene minimizzata la perdita complessiva

da Pezzi et al., – In AA.VV., 2008


wound
bundles
pedicel


Hidden losses


Vine losses


Soil losses

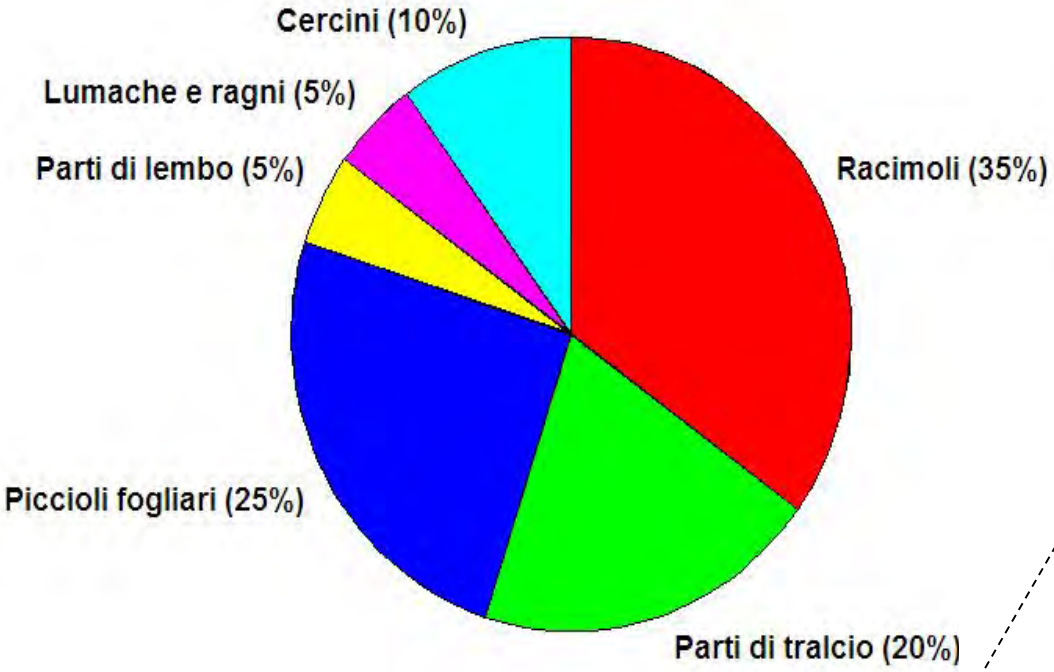

Many cluster parts


Juicy!


Single berries

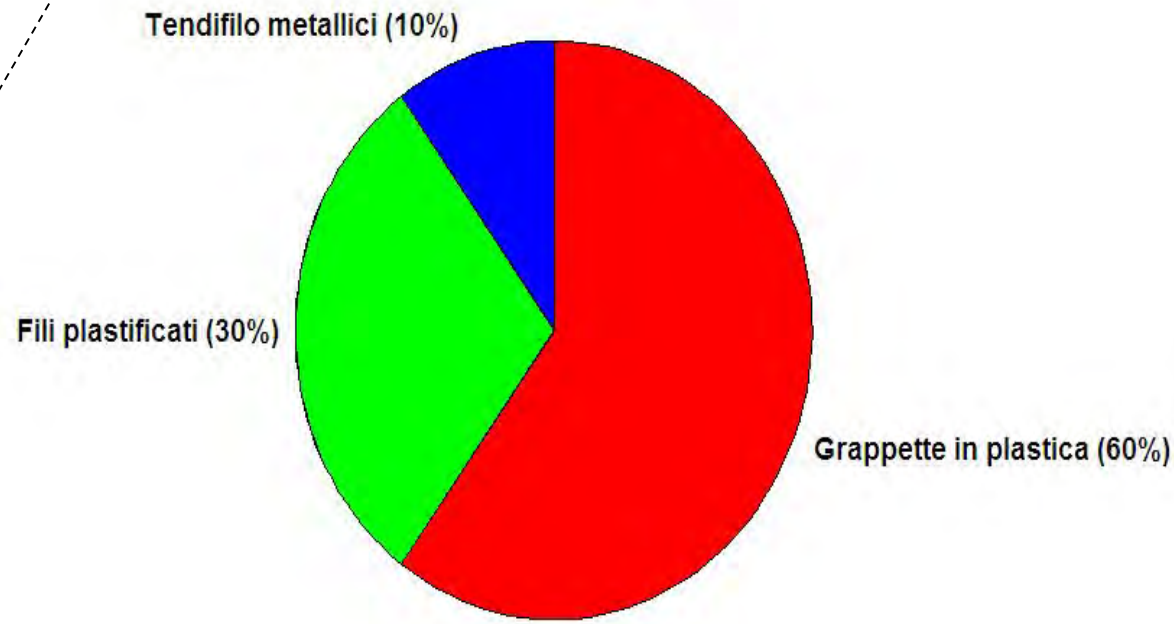
# Cvs. and suitability to mechanical harvesting

| Easy | | Average | | Difficult | |
|---|---|---|---|---|---|
| Cv. | Juice | VARIETA' | Juice | VARIETA' | Juice |
| CHARDONNAY | Low | SAUVIGNON | Avg. | PINOT GRIGIO | Avg-high |
| VERDUZZO FRIUL. | Avg | PROSECCO | High | PINOT BIANCO | High |
| I.M. 6013 | Low | MERLOT | Avg. | TREBBIANO | Avg.-High |
| RIESLING | Low | REFOSCO | Avg.high | MOSCATO | Avg- High |
| CABERNET FRANC | Low | RABOSO | Low-avg. | | |
| CABERNET SAUV. | Low | PINOT NERO | Avg.-high | | |
| CARMENERE | Low | TOCAI | Avg. | | |
| RIBOLLA | Avg. | TRAMINER | Avg.-high | | |
| SANGIOVESE | Low | MALVASIA ISTRANA | Avg. | | |
| ANCELLOTTA | Avg. | MULLER THURGAU | Avg. | | |
| | | FRANCONIA | | | |




**Organic MOG (90% of total)**

**Inorganic MOG (10% of total)**




MOG is: materials other than grapes


Unripen Pinot Grigio

**Severe water stress**

**More difficult mechanical harvesting**

## ETA' DELLE PIANTE

**Tocai**

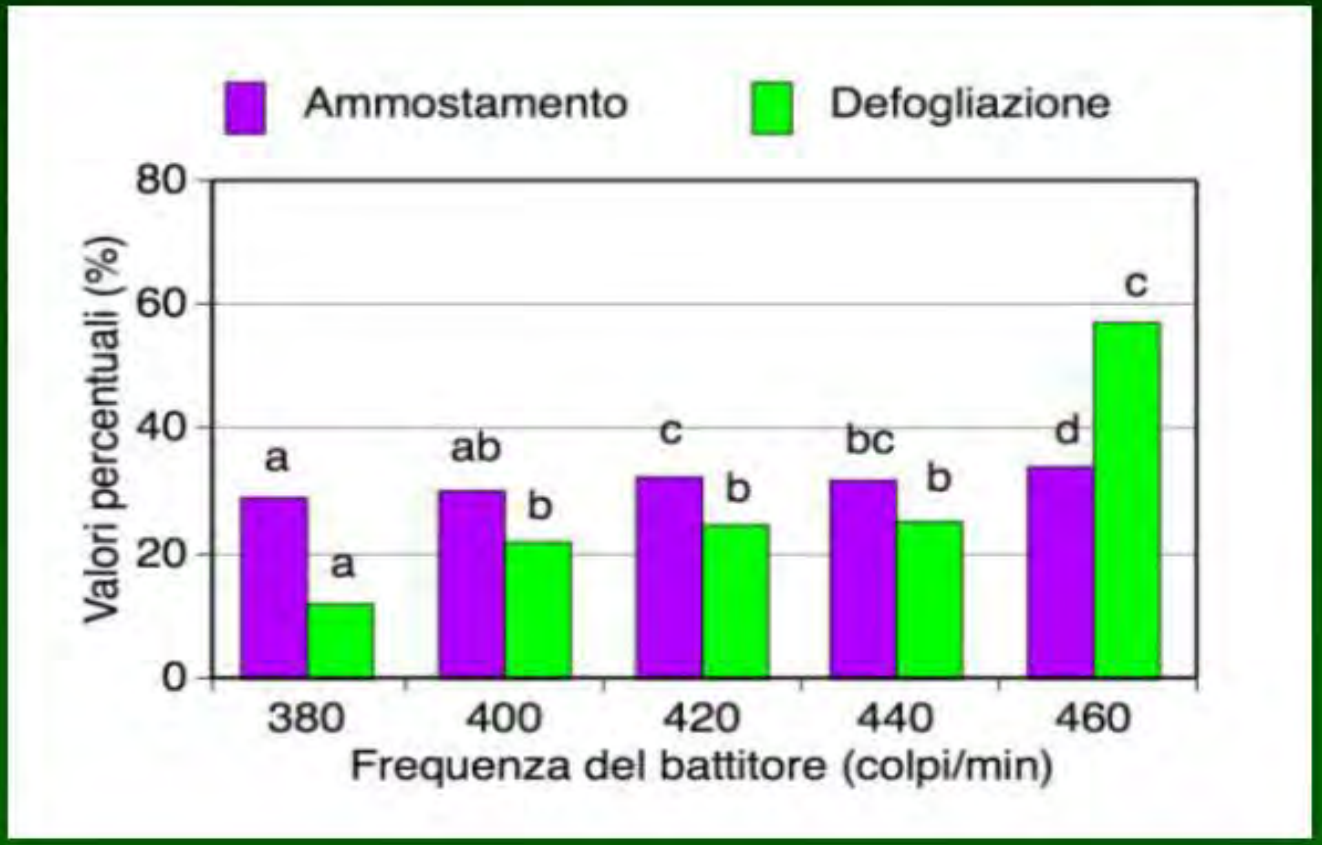
**Vendemmia meccanica al**

**2° anno**


Accessori
Argh!!!!!

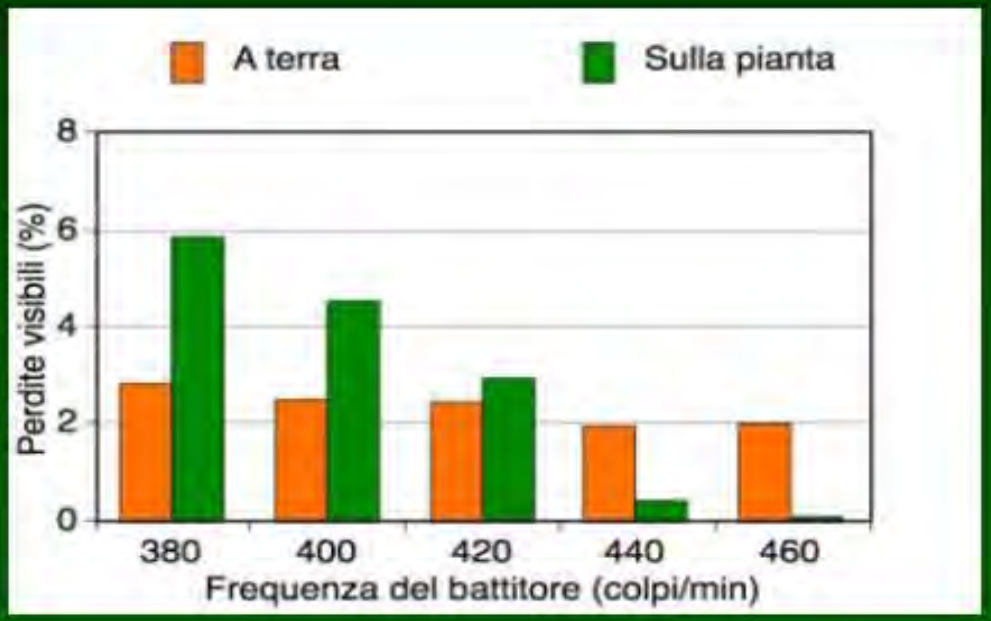
# Post-harvest canopy washing

# Effetti sul prodotto e sulle piante

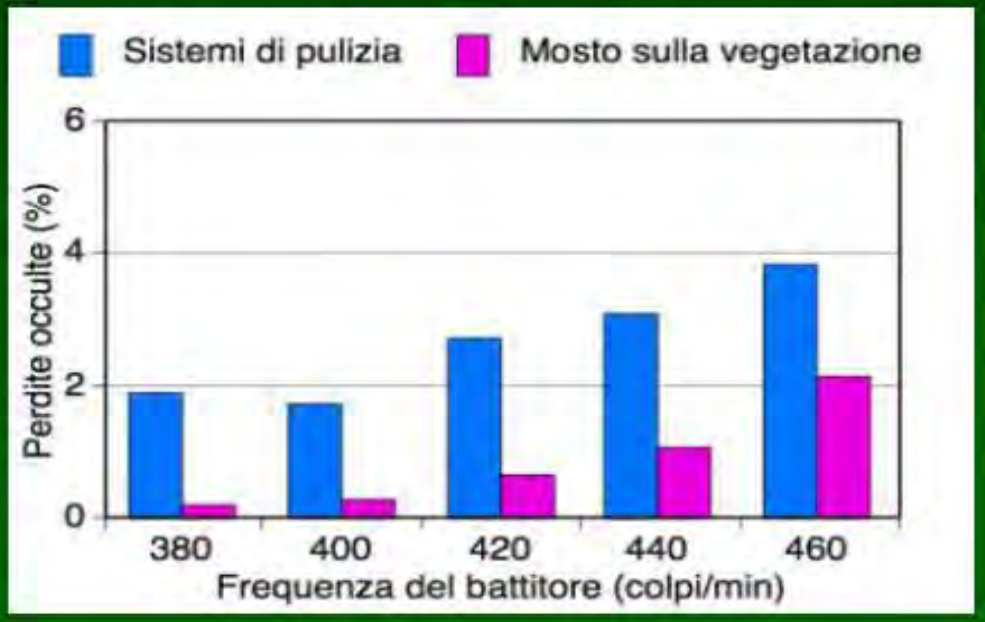



# Perdite di raccolta

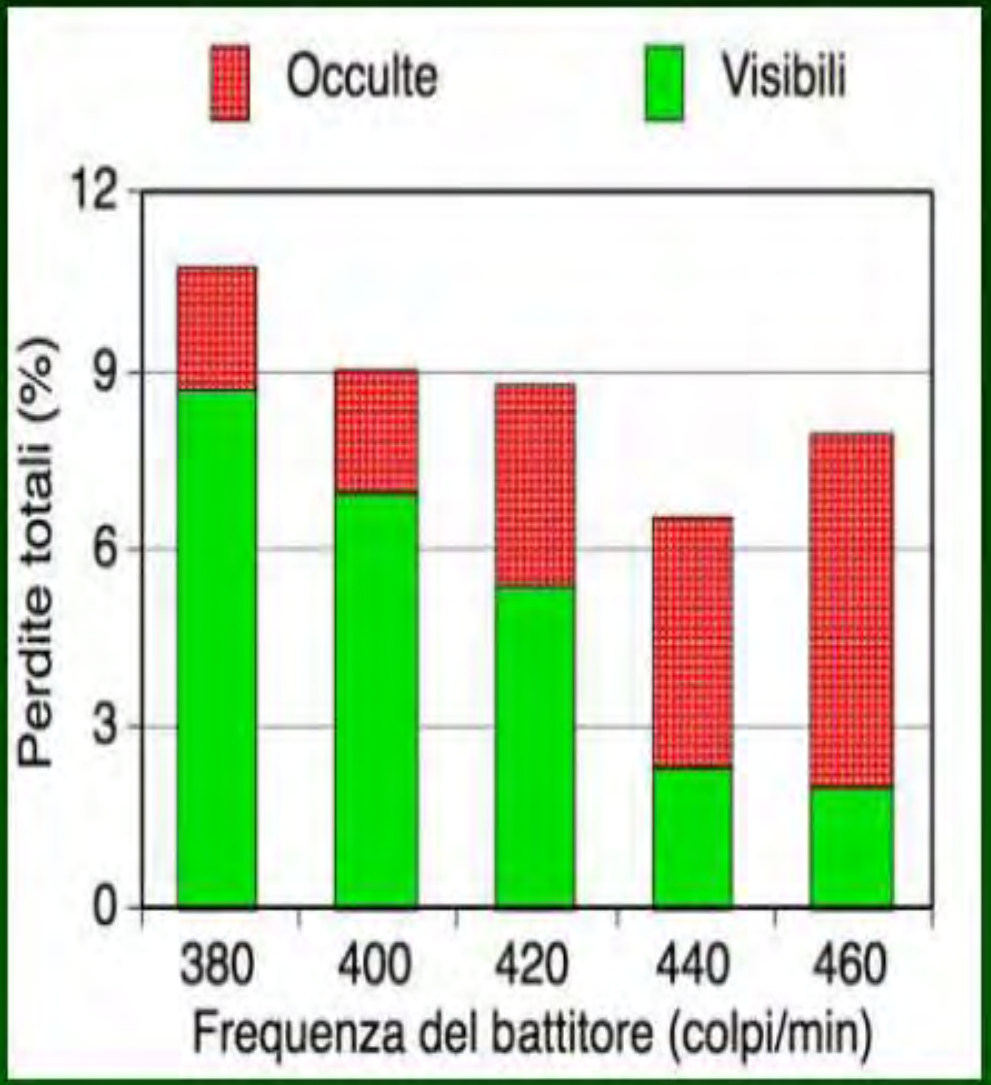
## VISIBILI



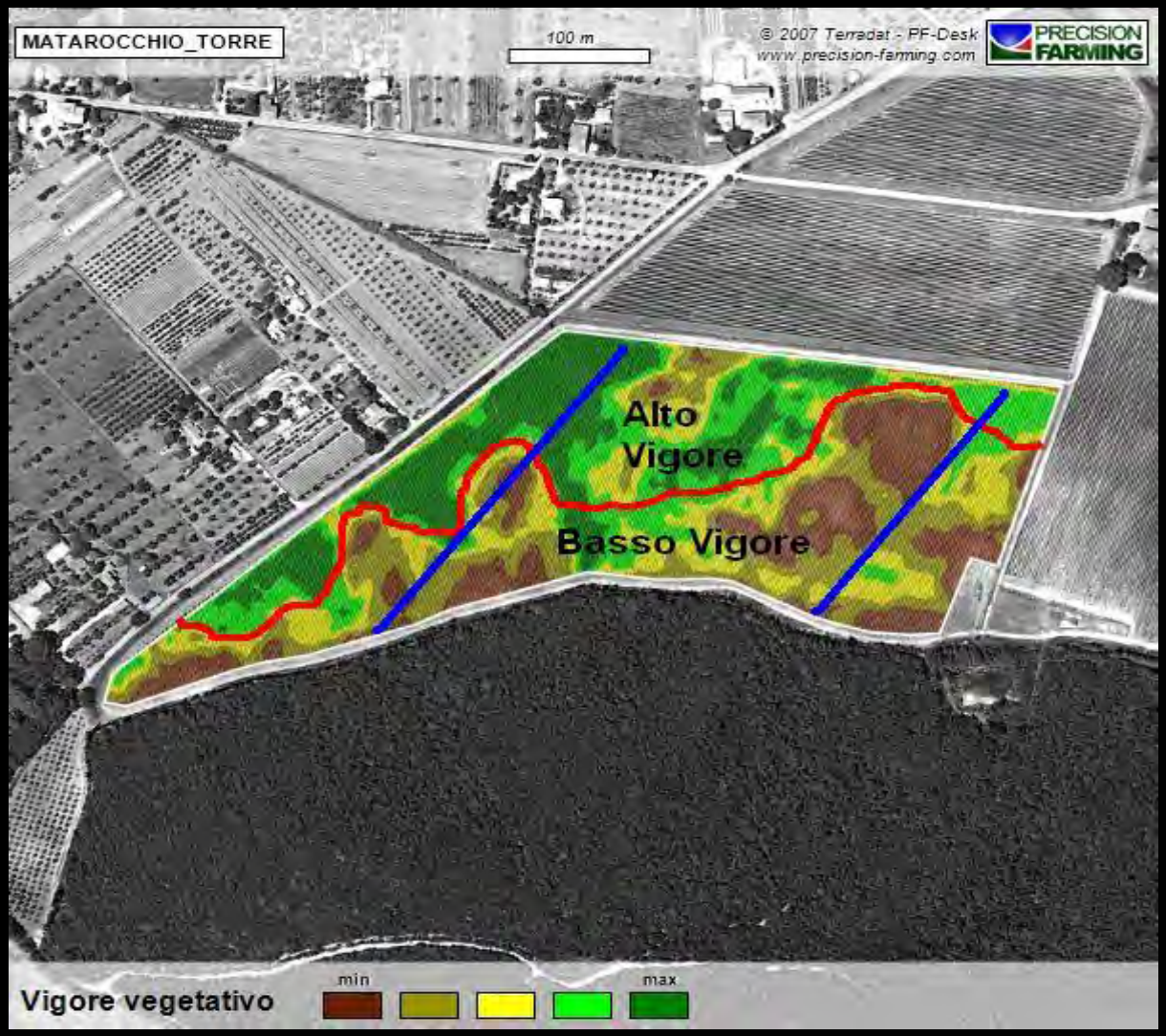

## OCCULTE



# Perdite totali



# Vigor map




da Matteo Bertè, Relazione di Stage UCSC, 2008