WEA Conference – 7 September 2016

The Australian Wine Research Institute

Dom Pérignon (1638 – 1715)

Sorting in Champagne c. 1930s

Innovations & options for grape sorting

Simon Nordestgaard
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Manual sorting (modern configurations)

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- Before and/or after destemming
- Belt and/or vibrating conveyors (with juice drainage)
- High labour, slow throughput
- Still often used in conjunction with automated sorting equipment

2-stage vibrating/belt sorter (c. 1990s)

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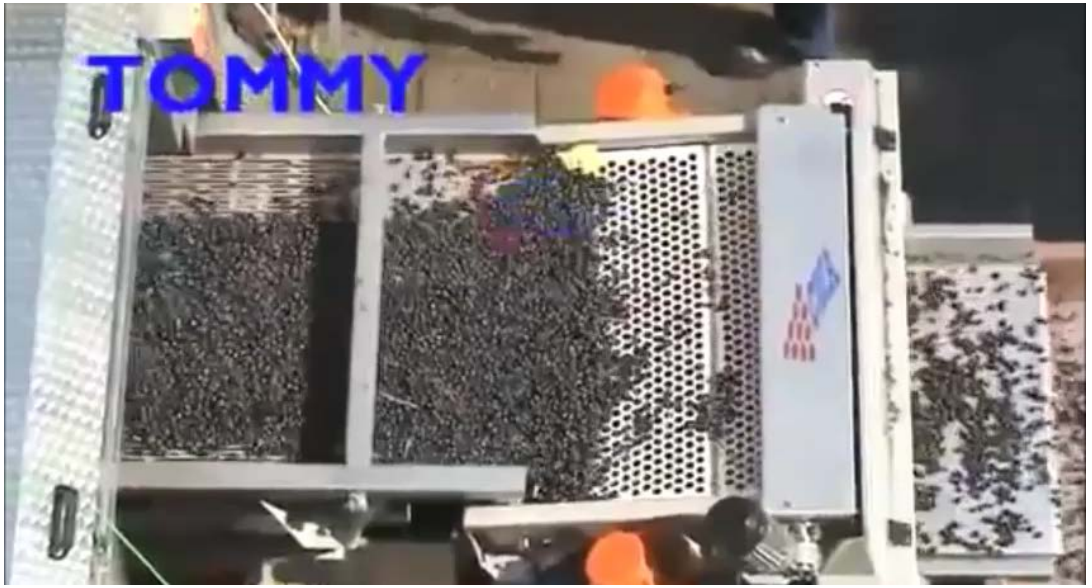
- 2 stages:
  - 1. Vibrating screen - smalls and juice fall through
  - 2. Vibrating screen/holed belt - grapes fall through
- e.g. Enoveneta TSA, CMA Tommy
- Throughputs: < 7-15 & 3-6 t/hr*



*Nominal capacity, i.e. may overstate real capacity

Air-jet – gravity fed (Vaucher-Beguet Mistral, c. 2004)

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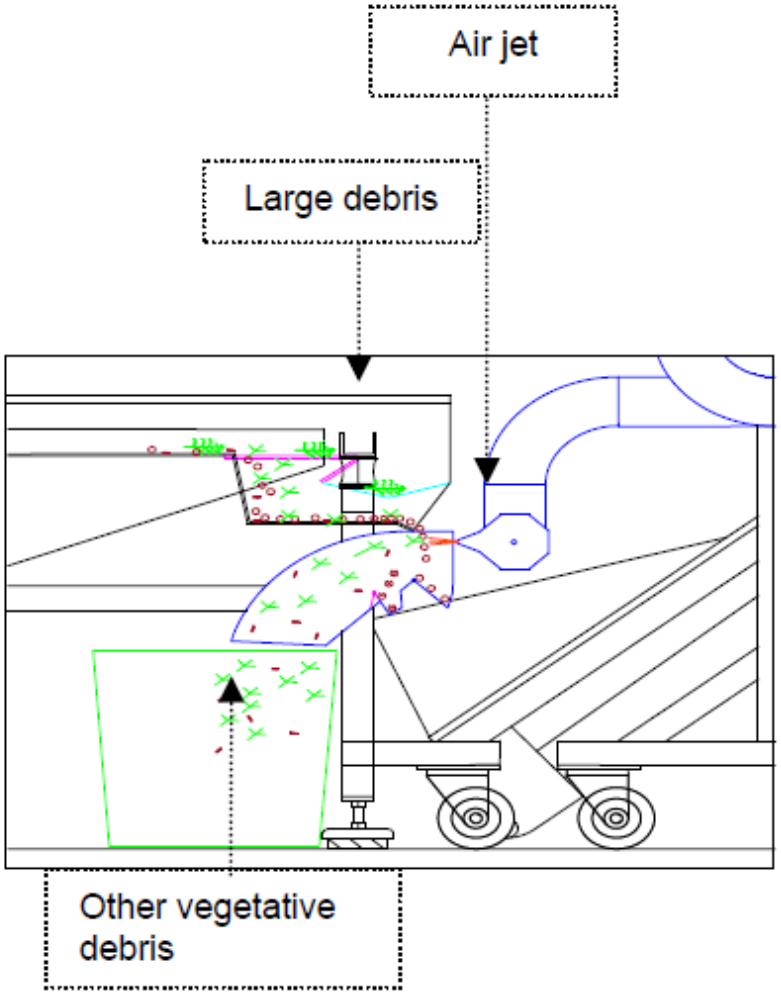

- 2-stage vibrating + air-jet
- Air-jet blows away light materials as they fall off an edge - petioles, leaves, larger raisins and smashed grape skins (Fraser 2012)
- Throughputs: 2-3, 5-7, 6-9 t/hr*

Fraser (2012) Adelaide 2011 ASVO seminar.

*Nominal capacity, i.e. may overstate real capacity

Vaucher-Beguet Mistral - Video

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Air-jet – fast belt (Bucher-Vaslin Rflow, c. 2013)

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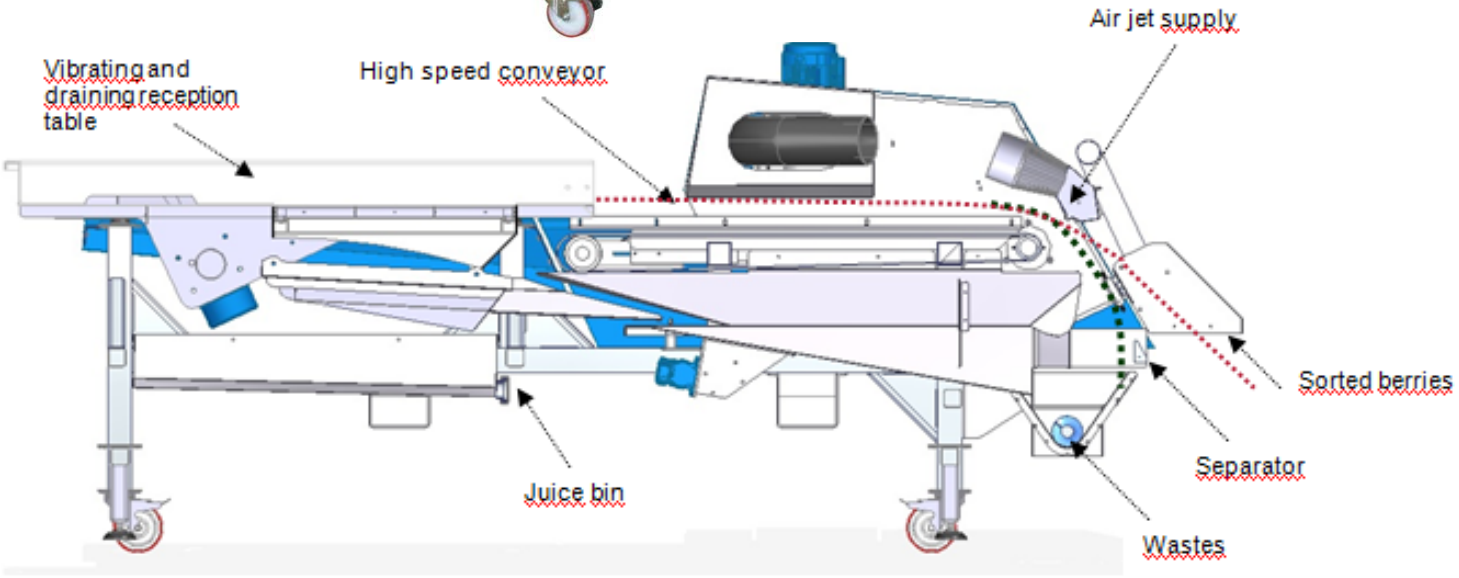
- Material accelerated by belt to spread them out, allowing higher throughput per width
- Throughput: <15 t/hr*



*Nominal capacity, i.e. may overstate real capacity

Bucher-Vaslin Rflow - Video

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SOCMA linear winery destemmer – c. 1999

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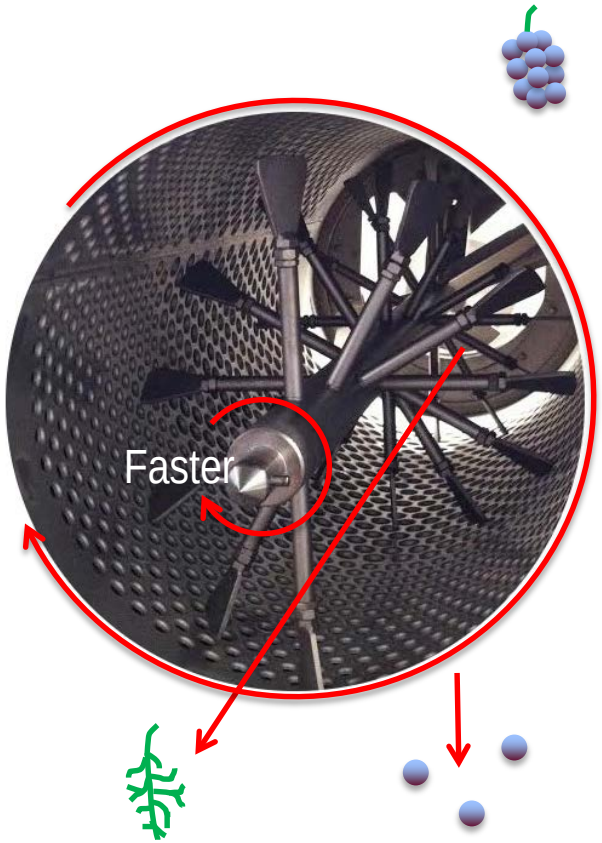
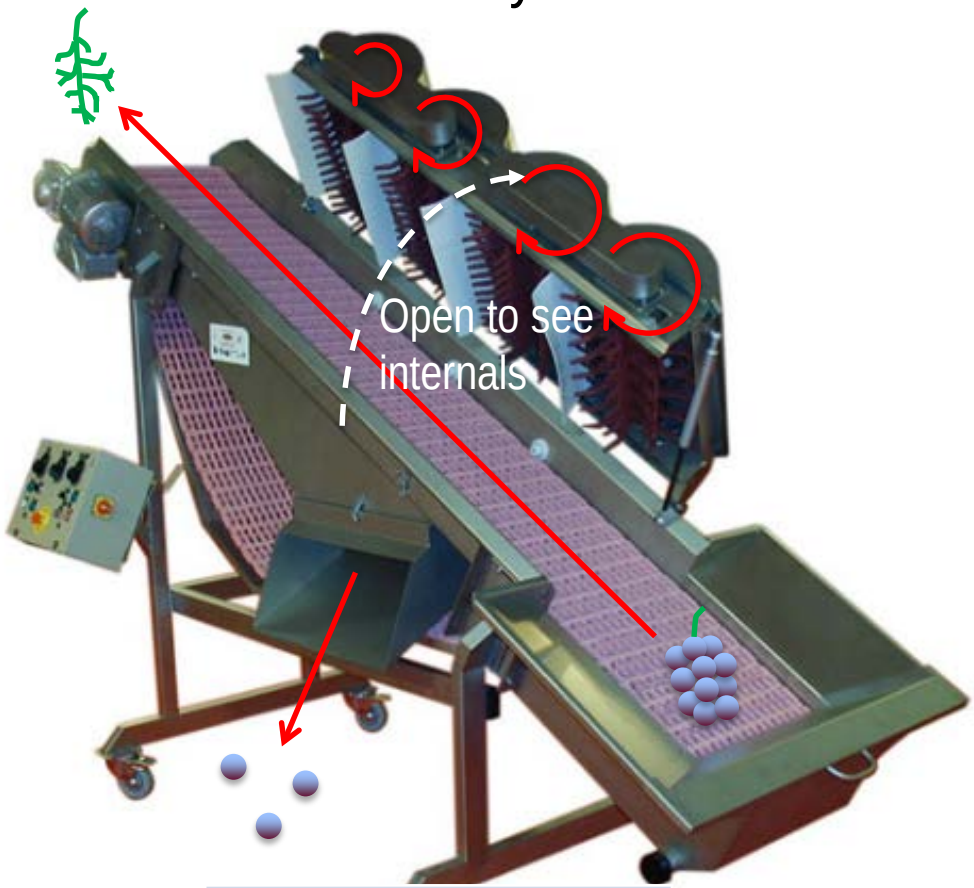
Rotary winery destemmer (traditional)



23% juice

1.5% vegetal matter

SOCMA linear winery destemmer



12% juice

0.9% vegetal matter

Trial data from SOCMA website for hand-picked grapes

Armbruster Rotovib destemmer (c. 2006)

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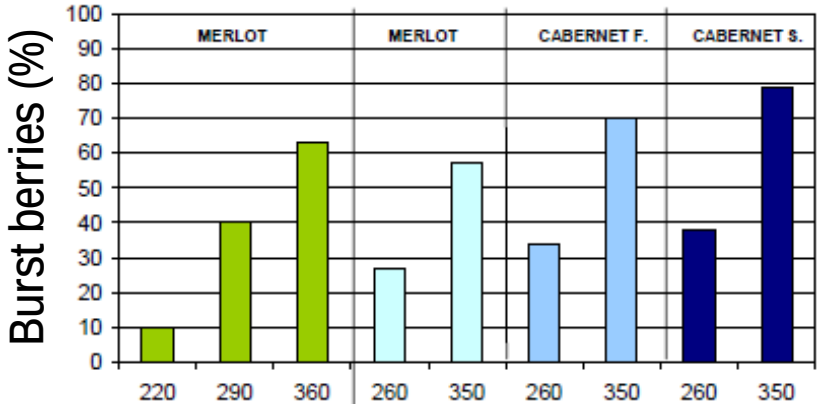
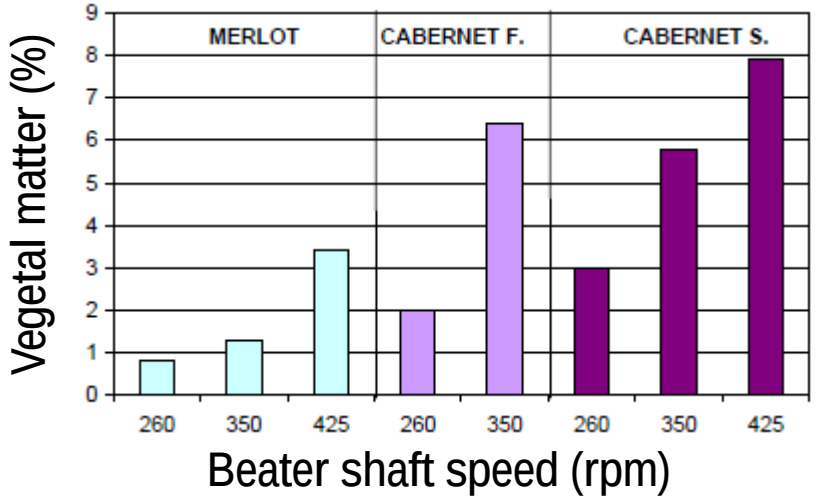
- Influence of beater shaft speed (Vinsonneau and Vergnes 2000):





http://www.matevi-france.com/uploads/tx_matevibase/Conditions_d_utilisation_d_un_erafloir_1995_-_1997.pdf

- Similar to traditional rotary destemmer but shaft vibrates
- Some grape detachment by vibration
- Lower shaft rotation speed required
- Throughputs: < 10, 20 & 30 t/hr*

*Nominal capacity, i.e. may overstate real capacity

Armbruster Rotovib - Video

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Pellenc Selectiv' destemmer-sorter (c. 2008)

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- Bunches conveyed by sectioned grid conveyor and overhead shark-fins
- Grape detachment by vibrating rods
- Two-stage roller sorting
  - 1. Smalls and juice fall through
  - 2. Grapes fall through
- Throughputs: < 4, 3-10 & 7-20 t/hr*

*Nominal capacity, i.e. may overstate real capacity

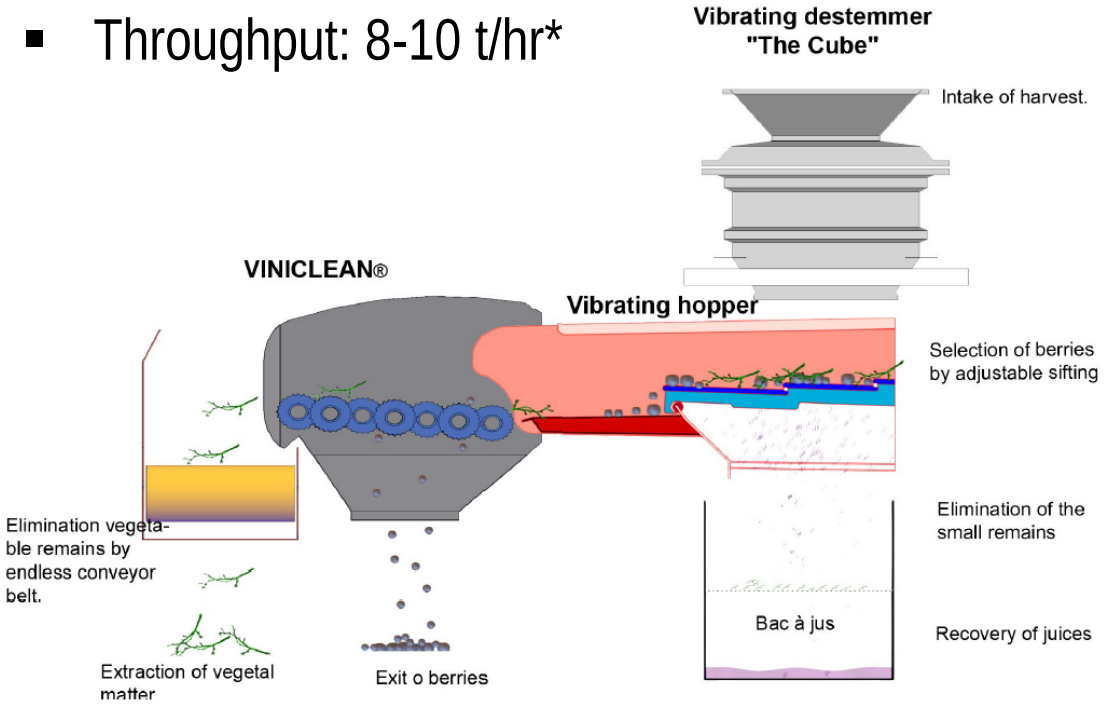
Pellenc Selectiv' - Video

The Australian Wine Research Institute

SOCMA Cube destemmer-sorter (c. 2010)

The Australian Wine Research Institute

- Bunches conveyed by gravity & star wheels
- Grape detachment by vibrating rods
- Two-stage sorting
  - 1. Vibrating – smalls and juice fall through
  - 2. Rollers – grapes fall through
- Throughput: 8-10 t/hr*



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SOCMA Cube - Video

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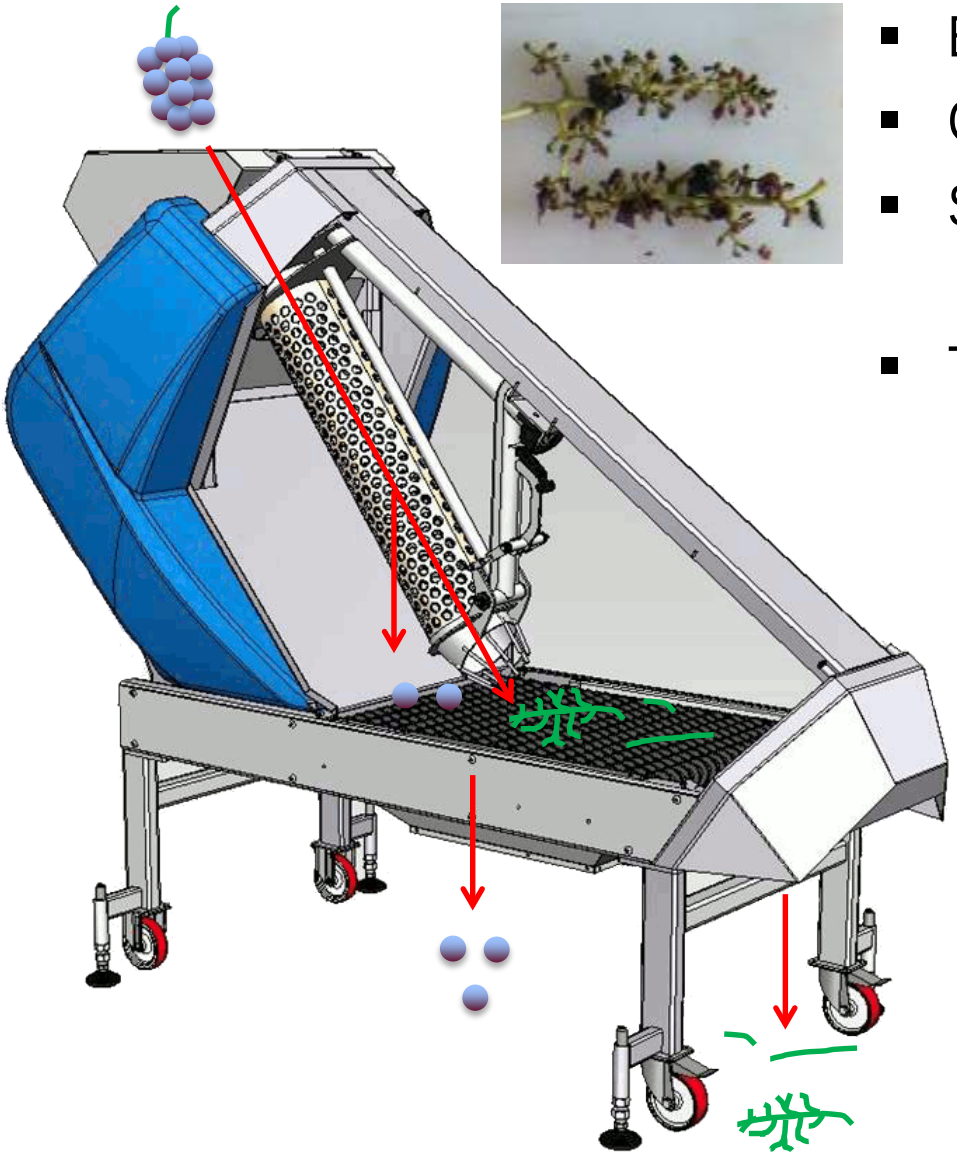
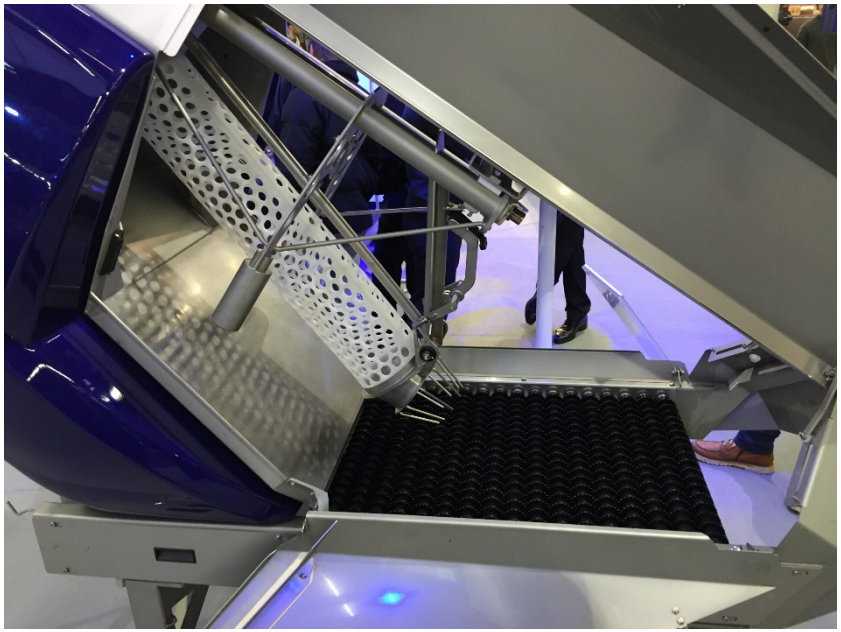
Bucher-Vaslin Oscillys destemmer-sorter (c. 2011)

The Australian Wine Research Institute



- Bunches conveyed by gravity
- Grape detachment in shaking cage(s)
- Single-stage roller sorting
  - Grapes, juice, smalls fall through
- Throughputs: 3-8 & < 20 t/hr* (1-2 cages)



*Nominal capacity, i.e. may overstate real capacity

Bucher-Vaslin Oscillys - Video

The Australian Wine Research Institute

Roller sorting (standalone units)

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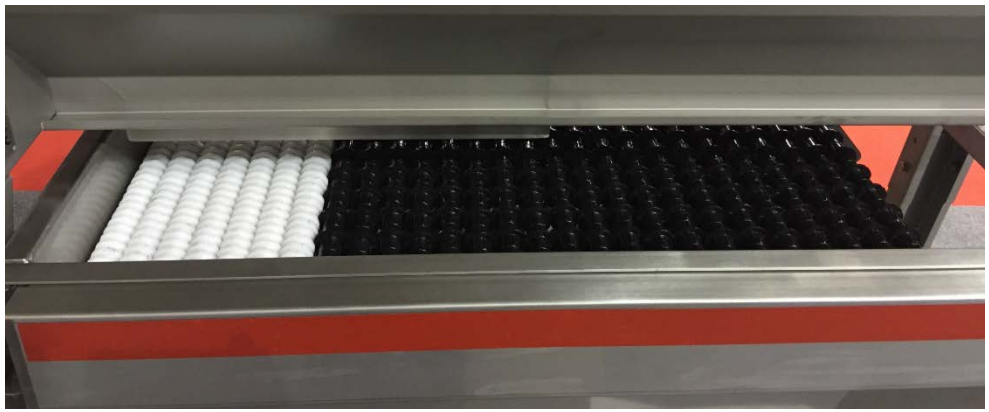
- Single or 2-stage rollers (Pellenc-style)
- Spreading systems on larger devices – vibrating, sweeping arms
- Throughput: as high as 25 t/hr*



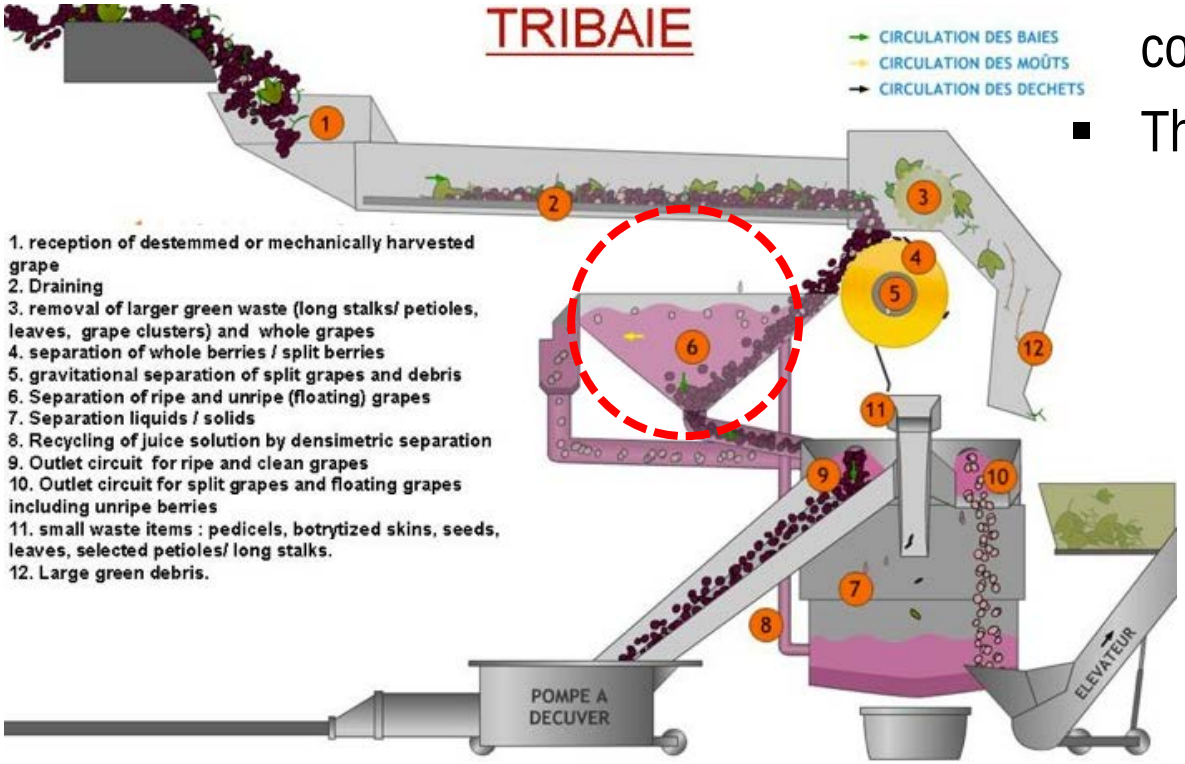
*Nominal capacity, i.e. may overstate real capacity

Bucher Vaslin Trio - Video

The Australian Wine Research Institute

Density sorting (AMOS Industrie Tribaie, c. 2005)

The Australian Wine Research Institute



- Multi-stage system
- Grapes also sorted on density
  - Ripe grapes sink and unripe grapes float in sugar/juice solution of set Brix
- Density bath can also be used for cooling
- Throughputs: < 5, 10, 20 t/hr*

*Nominal capacity, i.e. may overstate real capacity

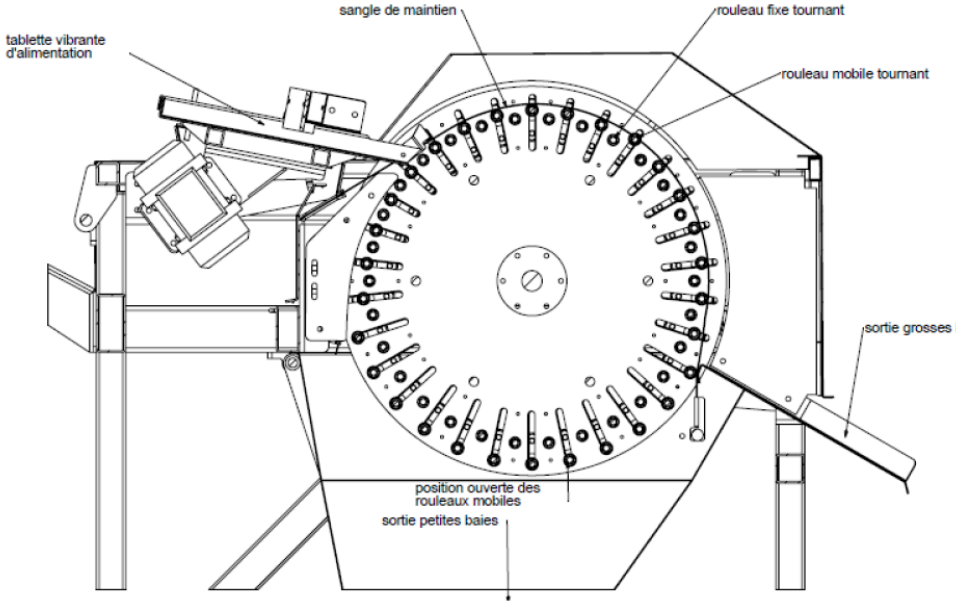
AMOS Tribaie - Video

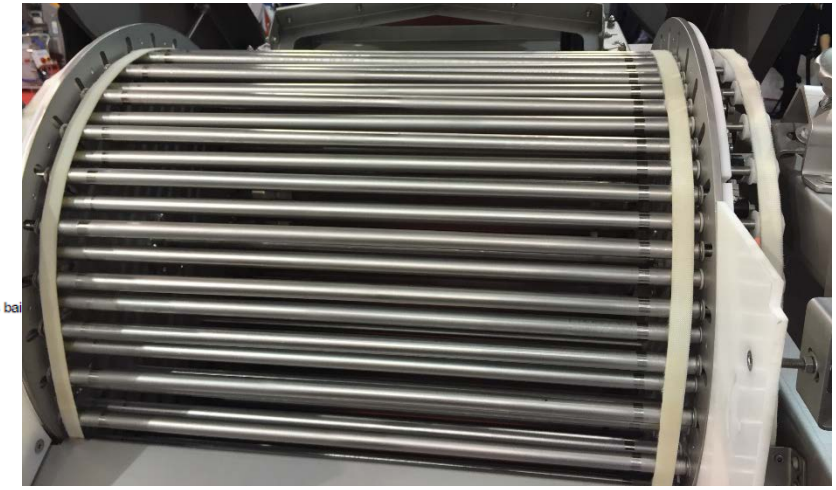
The Australian Wine Research Institute

Grape size sorting (AMOS Industrie Calibaie, c. 2014)

The Australian Wine Research Institute

- Sorts grapes according to diameter
  - Grapes larger than set roller gap travel across the top of roller drum
  - Grapes smaller than set roller gap fall into roller drum at the top and fall out at bottom (strap releases spring-loaded rollers at bottom of rotation)
  - Designed to be used after sorting by Tribaie
- Throughput: 4-8 t/hr*





*Nominal capacity, i.e. may overstate real capacity

AMOS Calibaie - Video

The Australian Wine Research Institute

Optical sorting (c. 2008, earlier in other industries)

The Australian Wine Research Institute

- Devices sort according to size/shape, colour
  - (and sometimes other spectral regions – e.g. red light fluoresces chlorophyll in vegetal matter & detected in the NIR)
  - More flexibility than mech. sorting – software not hardware
  - Ability to detect mouldy red grapes? slight ripeness differences?
- Process:
  - Pre-draining by vibrating screen
  - Material spread and imaged (while gravity falling for some low throughput, or on a fast belt for high throughput machines)
  - Defects ejected by air nozzles

Manufacturers with off-the-shelf products:

- Bucher-Vaslin Vistalys: 3-5 & <10 t/hr*
- Pellenc Selectiv' Process Vision: <12 t/hr*
- Protec X-Tri: 1.5-3.5, 3-10 & 6-12 t/hr*
- Key/Enoveneta VitiSort: <5 t/hr*
- WECO/Scharfenbeberger WineGrapeTEK: <5.4 t/hr*
- Armbruster (new unit < 5 t/hr*), Siprem unit coming soon

*Nominal capacity, i.e. may overstate real capacity

Optical sorters - different feed systems - Videos

The Australian Wine Research Institute

Key Vitisort
Gravity feed
Lower throughput

Bucher-Vaslin Vistalys
Belt feed
Higher throughput

Automatic winery sorters – costs and adoption* (as of Nov 2014)

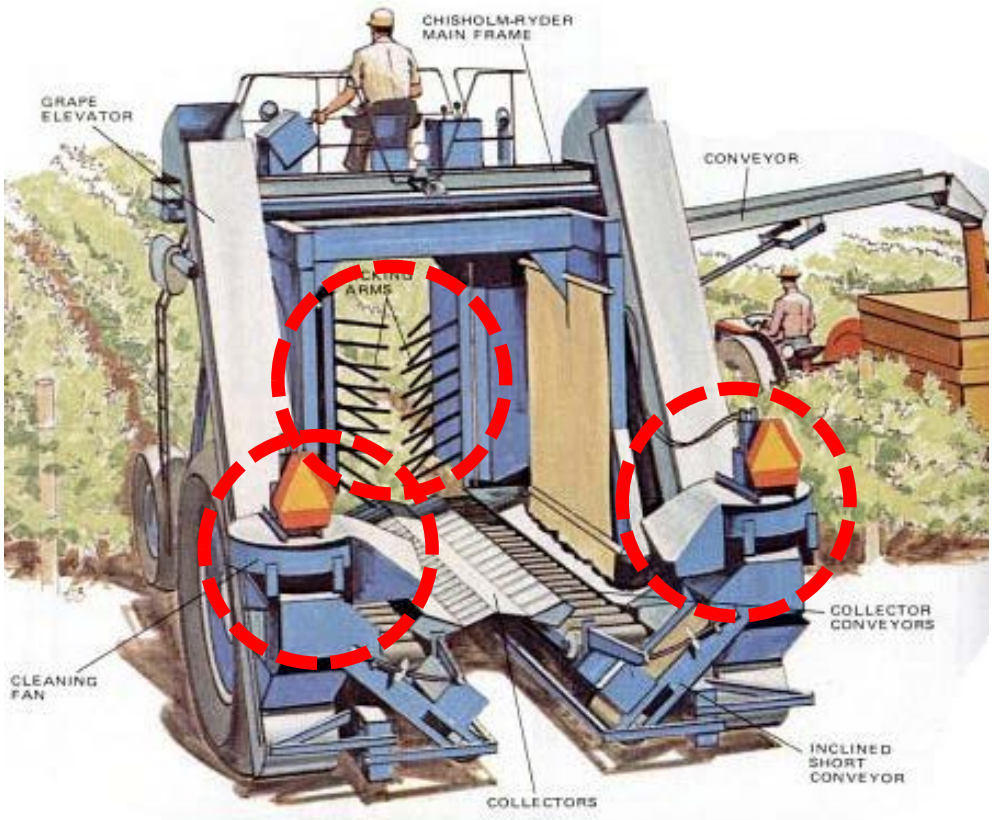
The Australian Wine Research Institute

Notable mechanism	Example brands and/or models	Throughput (t/hr)	Cost	# Australia	# World
Rollers	Bucher-Vaslin Delta Trio	<15	$25,000	~8	~150
	Integrated with vibrating destemmer – Pellenc/SOCMA/Bucher-Vaslin			~20	~1,000
2-stage vibrating	Enoveneta TSA	7-15	$30,000	~3	~150
Grape size	Amos Industrie Calibaie	4-8	$45,000	0	~10
Air-jet (gravity-fed)	Vaucher-Beguet Mistral	6-9	$60,000	~2	~350
Air-jet (fast-belt)	Bucher-Vaslin Rflow	<15	$55,000	0	~100
Density bath	Amos Industrie Tribaie	< 5	$120,000	0	~85
		< 20	$200,000		
Optical	Bucher-Vaslin, Pellenc, Protec, Key, WECO…	< 5	$90,000	~2	~250
		<10	$240,000		

*Order of magnitude values – for general technology comparison purposes only, other capacities available

Machine harvesters - c. 1970s

The Australian Wine Research Institute

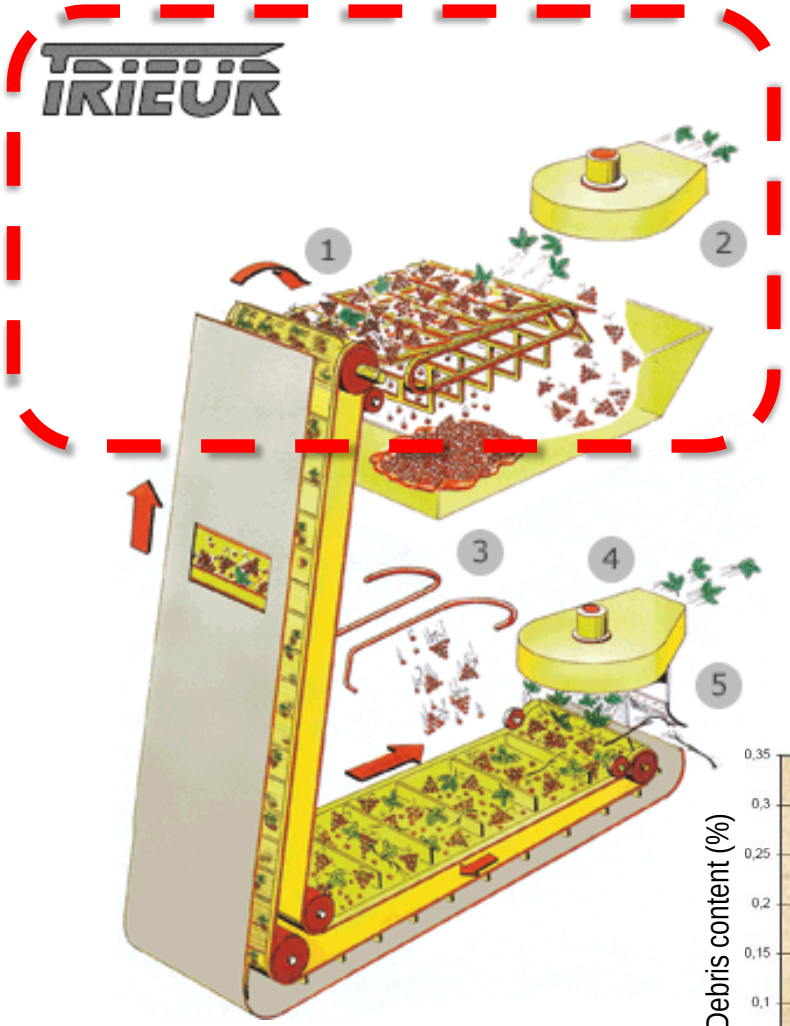


- Partial destemming
  - Many stems left on the vine
- Some sorting
  - Cleaning fans - leaves
- Vegetal matter in harvest
  - Hand-picked: ~7%
  - Machine-harvested: ~1-2%

Vegetal matter content estimates from Anneraud et al. (2012)

Pellenc Trieur grid-belt sorter - c. 1999

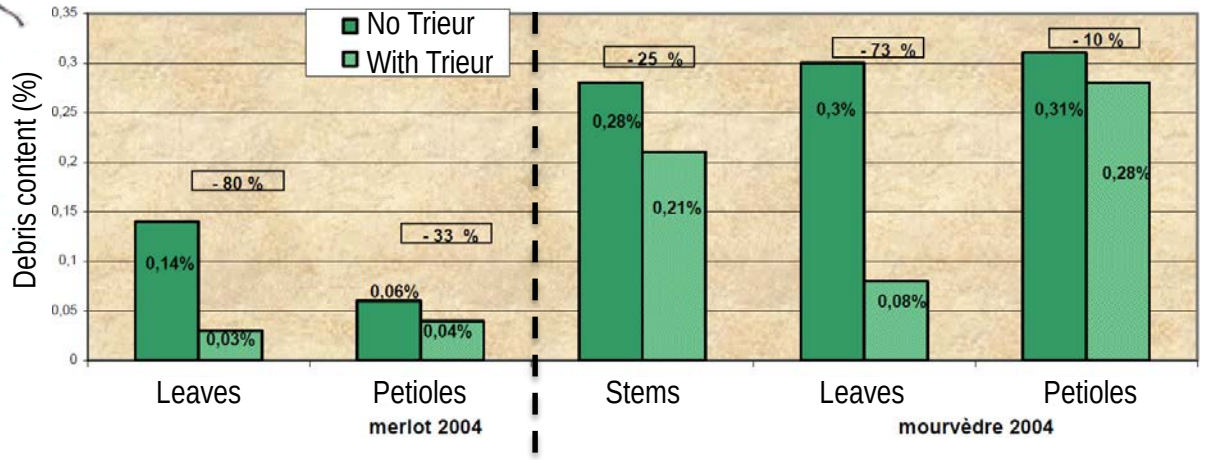
The Australian Wine Research Institute



- Free grapes and juice fall through grid-belt so top fan can clean more effectively / operate at higher suction without losing juice
  - Still mainly just removes leaves
  - Petioles pass / not sucked away

Debris content with and without Trieur top-fan turned on

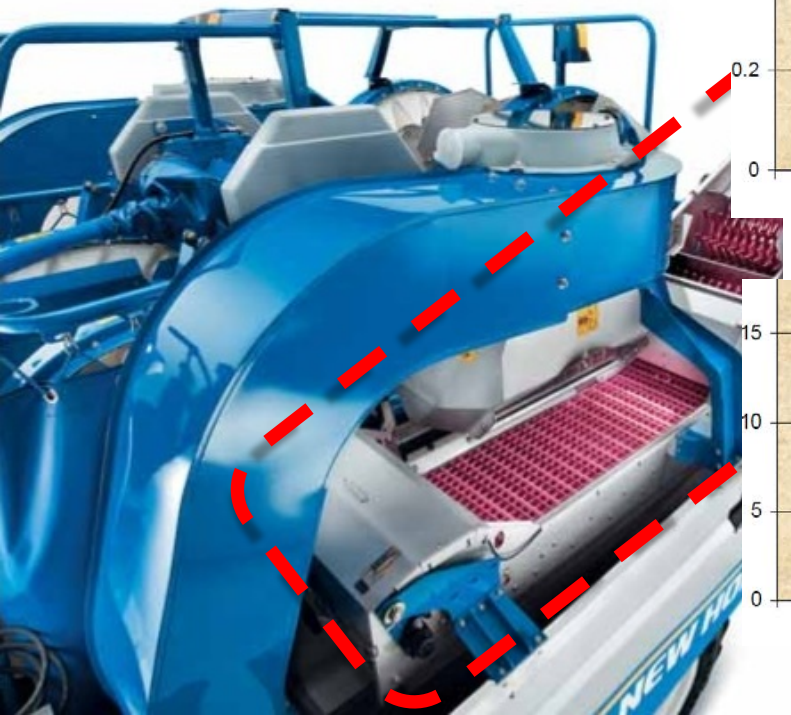
(Plot translated from Vinsonneau et al. 2005)



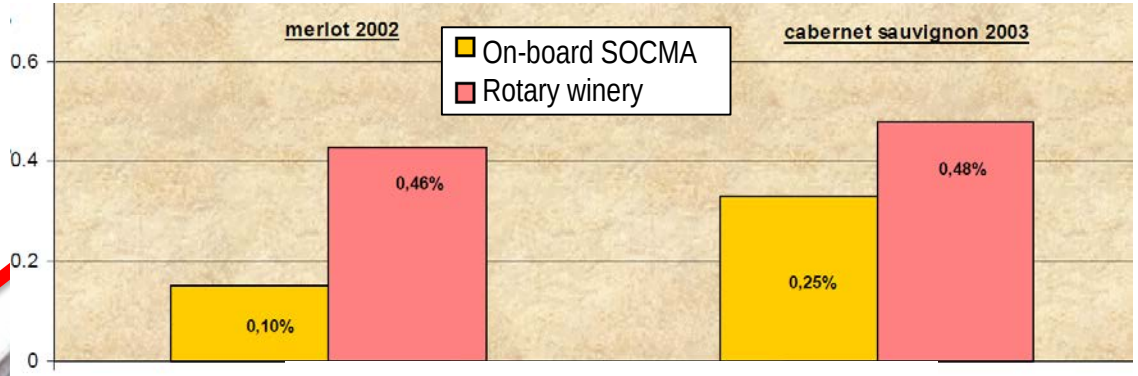
SOCMA destemmer on New Holland Braud harvester – c. 2002

The Australian Wine Research Institute

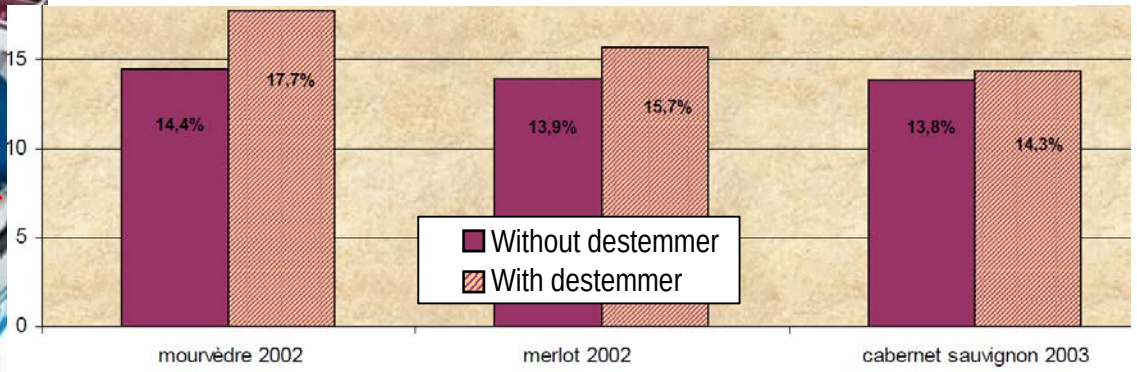
- Above bins on each side – still current destemmer for New Holland Braud harvesters
- Removed more vegetal matter than rotary winery destemmer
- Slightly more juicing at harvest than without destemmer



Stem content – on-board SOCMA vs. rotary destemmer at winery



Juice content – without or with on-board destemmer

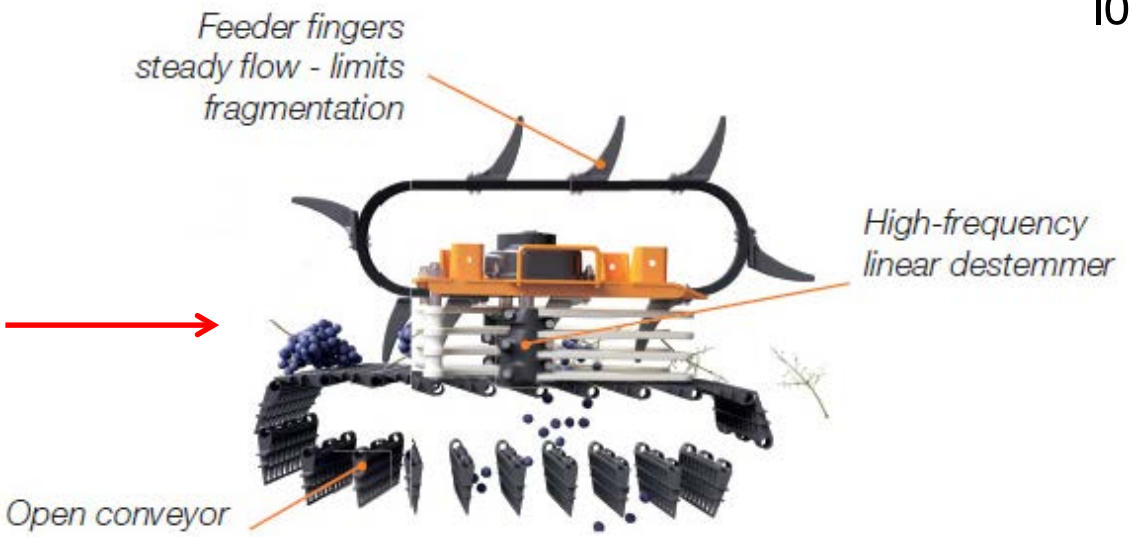


Plots translated from Vinsonneau et al. (2004)

Pellenc - Selectiv' Process 1 & 2 - c. 2007 & 2013

The Australian Wine Research Institute

- Pellenc's new shaking linear destemmer
- Roller sorting table including initial rollers to align petioles
  - Pellenc claim: "95% of petioles eliminated" (bigger than 35 mm long, IFV testing)



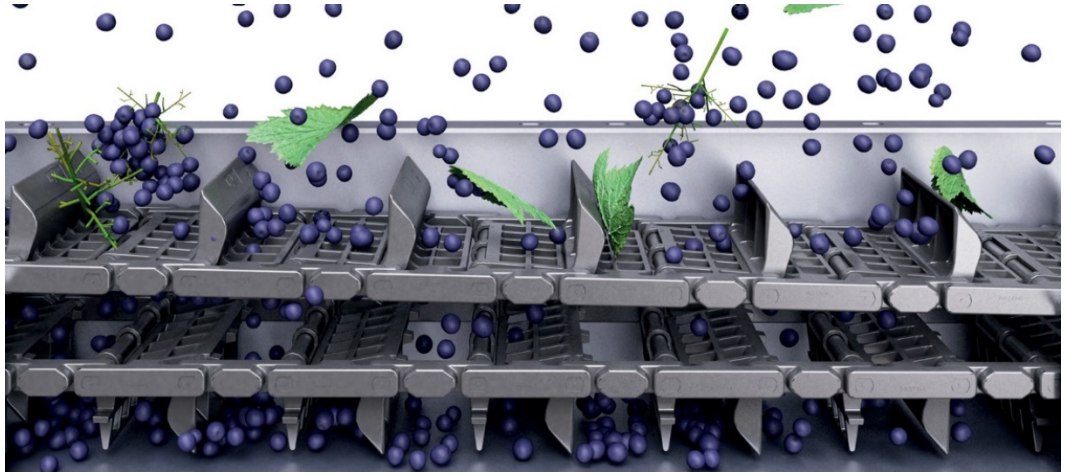
Pellenc – grid-conveyor sorter

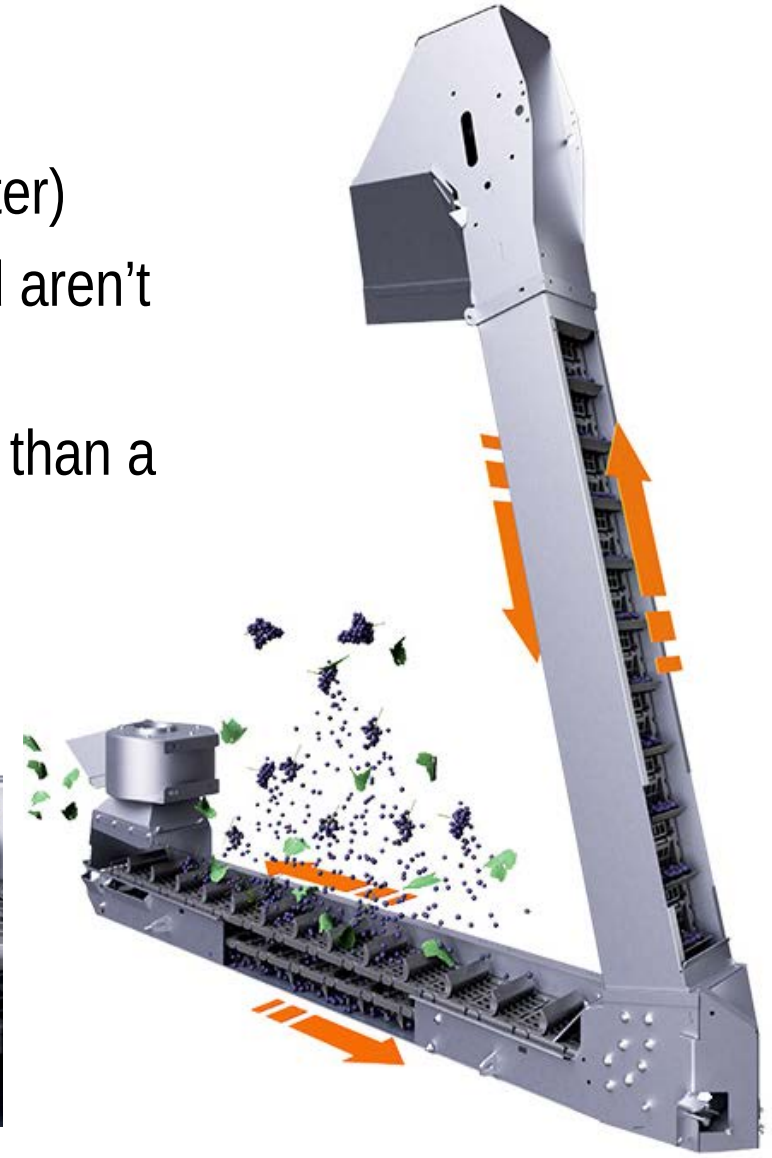
The Australian Wine Research Institute

- Grid for the whole conveyor

  (evolution of Pellenc's initial grid fan sorter)

  - Free grapes/juice can fall through and aren't exposed too directly to fans.
  - Pellenc claim "up to 5% more harvest than a competitive machine"





Video - Pellenc Selectiv' Process 2

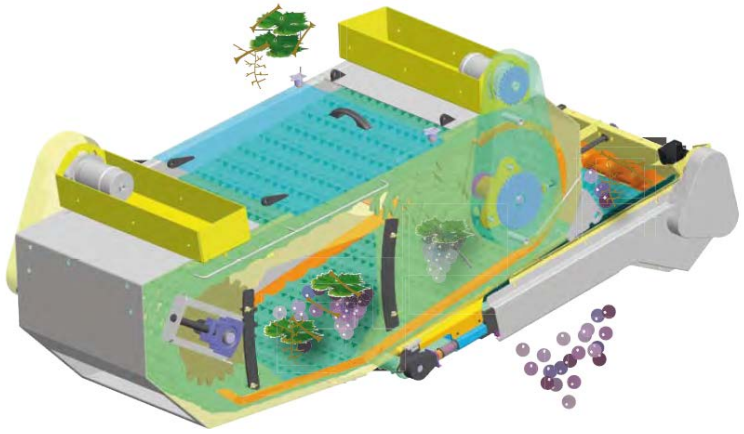
The Australian Wine Research Institute

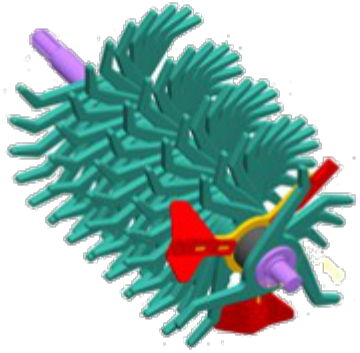
Gregoire Cleantech Vario - c. 2009

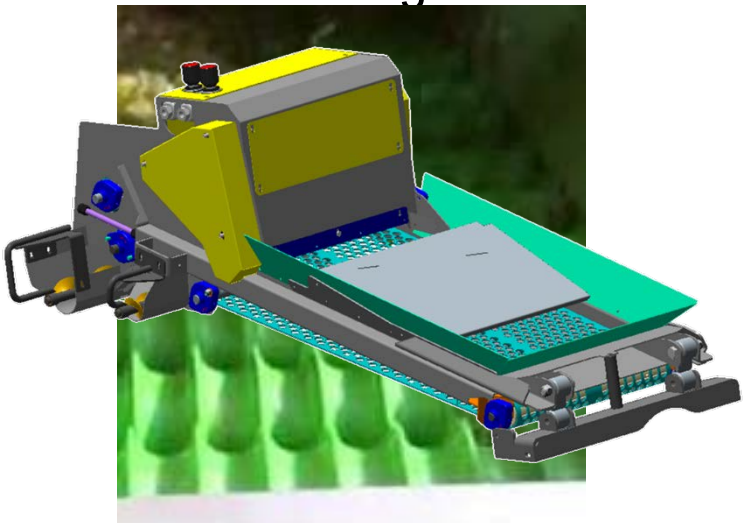
The Australian Wine Research Institute

- Gregoire Cleantech destemmer

  (cross between SOCMA destemmer and traditional rotary destemmer)
- Vario roller sorting table
  - In France they have also offered the ViniSelect holed shaking belt sorter (low throughput, c. 2013) instead of roller sorting







Video – Gregoire Cleantech Vario

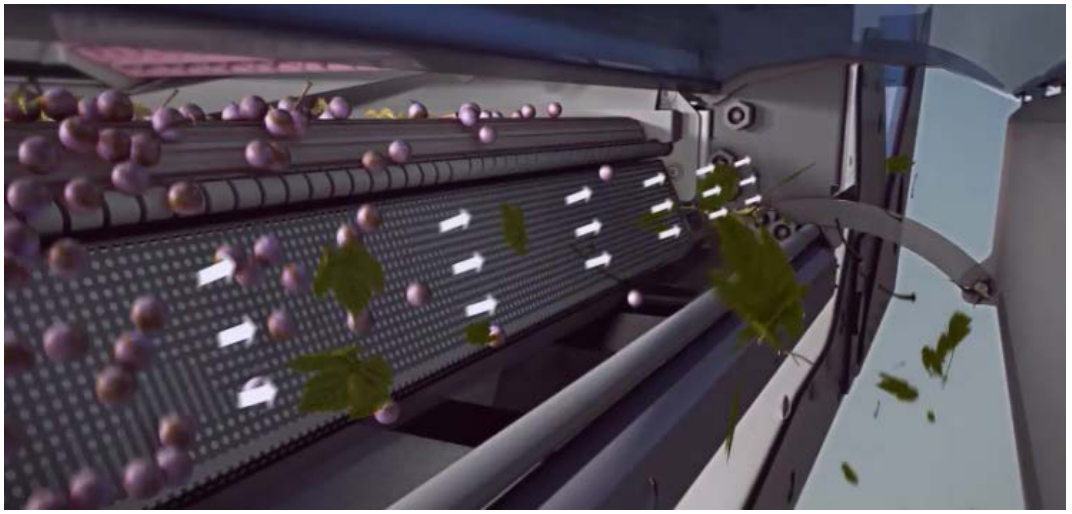
The Australian Wine Research Institute

New Holland Braud Opti-Grape - c. 2013

The Australian Wine Research Institute

- Still has SOCMA destemmer

  (after a new roller pre-sorting stage)
- Now has an air-cushion sorting stage
  - New Holland claim: “it is also effective at removing dry and mouldy fruit, and also botrytised fruit”



Video – New Holland Braud Opti-Grape

The Australian Wine Research Institute

ERO Vitiselect - c. 2013

The Australian Wine Research Institute

- Traditional rotary destemmer

  (ERO claim that they were first with an on-board destemmer in 1998)
- Roller sorting table
- Compatible with side-arm discharge conveyor

Video – ERO Vitiselect

The Australian Wine Research Institute

Oxbo PremiumSort - c. 2015

The Australian Wine Research Institute

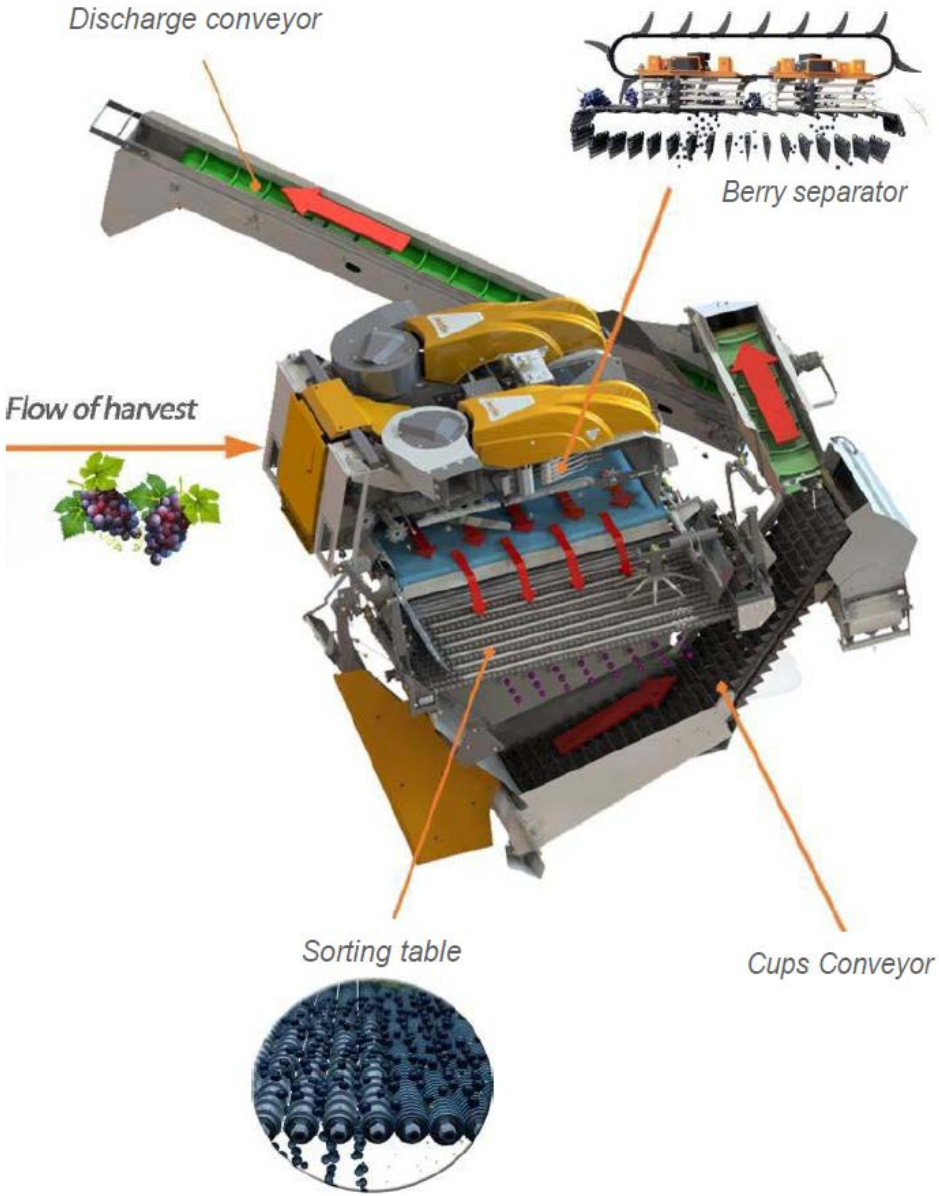
- Destemmer similar to Gregoire but is centrally and rear-mounted
- Ratchet motion sorting belt that grapes fall through
- Compatible with side-arm discharge conveyor

Video – Oxbo PremiumSort

The Australian Wine Research Institute

Pellenc Selectiv' Process 2 (XLE) – conveyor - c. 2015

The Australian Wine Research Institute

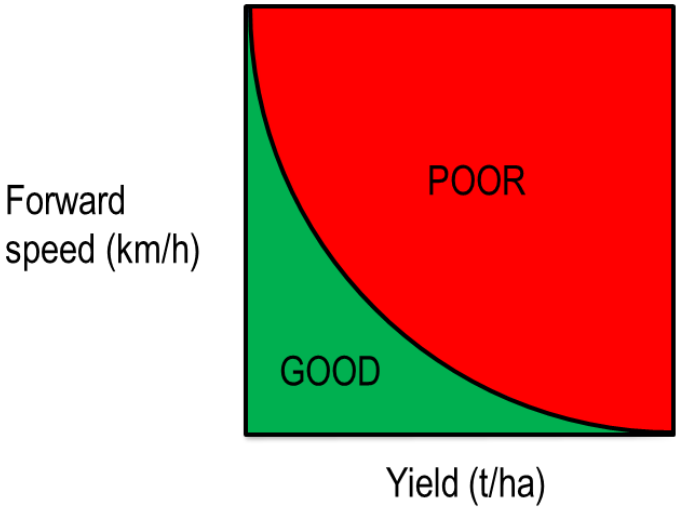


- Similar to model with twin on-board bins, but has side-arm discharge conveyor
  - Side-ways moving belt under destemmers transfers grapes to a single larger sorting table
  - Sorted grapes fall into a single buffer bin with a conveyor system in it that feeds the side-arm discharge conveyor
  - Buffer bin allows for storage when changing gondolas, etc.
- Demonstrations in USA and Australia last vintage

Speed and yield

The Australian Wine Research Institute

- Destemming and sorting systems may only process a certain throughput before their performance declines → losses or maceration



- Limitations model/conditions dependent – only have supplier recommendations (not independent – treat with considerable caution)
  - Pellenc: Destemmers "reach speeds up to 50 tonnes/ha at 4.5 km/hr"
  - New Holland Braud: Destemmer only "use in up to 20 tonnes/ha, shorter rows"
    Opti-Grape "use in up to 8 tonnes/ha, shorter rows"

Maintenance and cleaning

The Australian Wine Research Institute

- Destemming and sorting systems add complexity and moving parts
- One company I spoke with loved the harvest quality but experienced a few more breakdowns

  (will be model and conditions dependent)

Does sorting improve wine quality?

vineyard or winery

The Australian Wine Research Institute

- Complex question, factors include:
  - Grape and vine condition
  - Wine style
- With regards to removal of vegetal matter:
  - More important for reds than whites – most important factor is probably the long contact time during fermentation
  - Vinsonneau and Vergnes (2000): 1% additional vegetal matter can negatively impact quality for some red wines (this was added on top of the 0.5-2.1% that was already in the output from the destemmer)
  - Anneraud et al. (2012) trialled many pieces of winery sorting equipment
    - Before sorting vegetal matter was typically 0.4-1.7% and after was 0.1-0.4%
  - Ward et al. (2015): > 5% petiole addition required to produce significant sensory and chemical changes in a Cabernet Sauvignon (petiole addition increased floral characters)

Destemming/sorting in the vineyard or winery?

The Australian Wine Research Institute

- Red grapes/wine

  - If mechanically harvesting and want to sort, probably better to sort on harvester as the grapes will be in the most intact condition for sorting
  - One benefit of winery sorting is extra technologies (optical, density bath)

- White grapes/wine

  - On-board destemming could cause more grape maceration leading to more grape skin derived phenolics in the free-run (level of maceration will be brand/model/conditions dependent)

Adoption of on-harvester destemming and sorting

The Australian Wine Research Institute

- Currently low adoption in Australia relative to Europe and New Zealand
  - Low industry profitability
  - Vegetal matter left in the vineyard that currently get paid for by weight at the winery (and some good grapes – typically 0.5% in ITV/IFV studies)
  - Slower forward harvesting speeds in some instances
  - Increased maintenance
  - Side-arm discharge conveyor models only available recently

(the increased operating costs are likely more influential than capital costs – destemming/sorting system only 2-10% extra on $400K harvester)

Future – what will happen?

The Australian Wine Research Institute

- Sorting grapes for red wine production in Australia is likely to become more prevalent as producers seek to premiumise (more sorting is performed overseas).
- Shaking winery destemmers with in-built roller sorting will be adopted more widely for hand-picked grapes. Optical sorters will increase in prevalence as their price reduces and performance increases.
- Machine harvesters with on-board destemming and sorting will also be more widely adopted as a cost-effective means of sorting machine-harvested red grapes while they are in their most intact condition.

Acknowledgements and further resources

The Australian Wine Research Institute

- Suppliers who provided information on their winery/vineyard equipment and offered their perspective
- Wine industry personnel who offered their perspective
- People who posted videos of equipment operation on-line that I used/edited snippets from
- MatéVi – includes information on equipment trials performed by the French Institute of Vine and Wine (IFV)

MatéVi
BASE DE DONNÉES DES MATÉRIELS VITI-VINICOLES

http://www.matevi-france.com

Disclaimer

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The information contained in these slides should be considered general in nature, and viewers should undertake their own specific investigations before purchasing equipment or making major process changes.

The dates when different inventions were introduced and the order in which these inventions were made are presented in good faith based on information currently available. Some limited comparisons between different equipment are made and these are again presented in good faith based on available information.

It should be noted that there is fairly limited rigorous independent information available on the relative performance of vineyard/winery equipment, particularly given the importance of equipment performance to all wine producers - both in terms of wine quality and productivity.

None of the information presented in this article should be considered as an endorsement of any product by the AWRI.

AWRI Vineyard and Winery Practices Survey

The Australian Wine Research Institute

Vineyard

How common are?

- Different vine orientations
- Different trellises
- Rootstocks
- Different pruning techniques
- Mechanical shoot thinning
- Mechanical leaf plucking
- Precision viticulture
- Side-arm harvesters
- Harvest bins vs gondolas
- Metal posts

What are the key?

- Pest and disease issues
- Vine nutrition issues

Winery

How common are?

- YAN measurements
- Colour measurements
- Juice flotation
- White skin contact
- Hyperoxidation
- Different yeasts
- Wild ferments
- Cold soaks
- Vinimatics
- CMC for cold stabilisation
- Plant-derived fining proteins
- Different bentonites
- Wine/lees cross-flow filtration
- Screw-caps and corks

www.winesurvey.com.au

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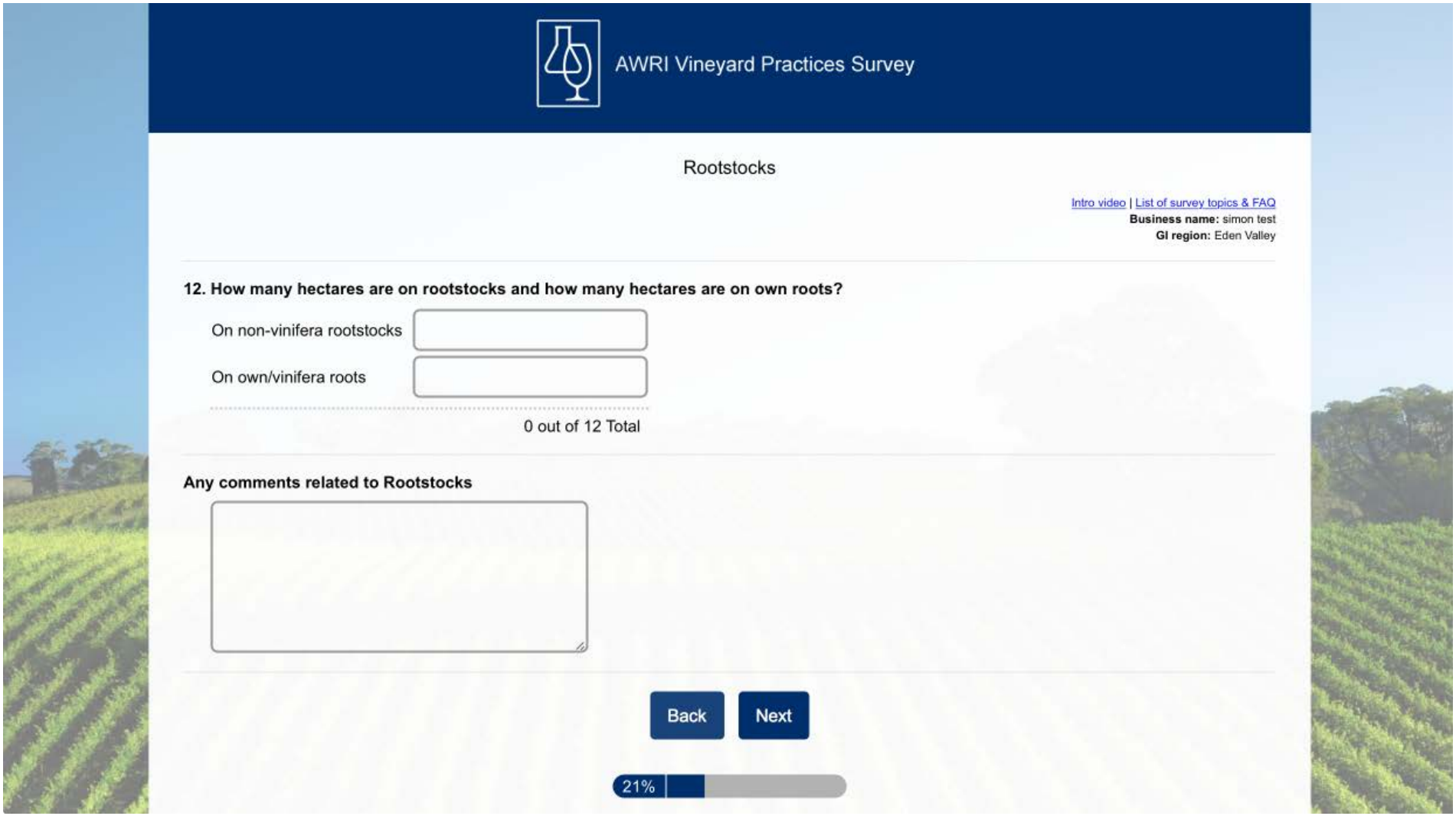

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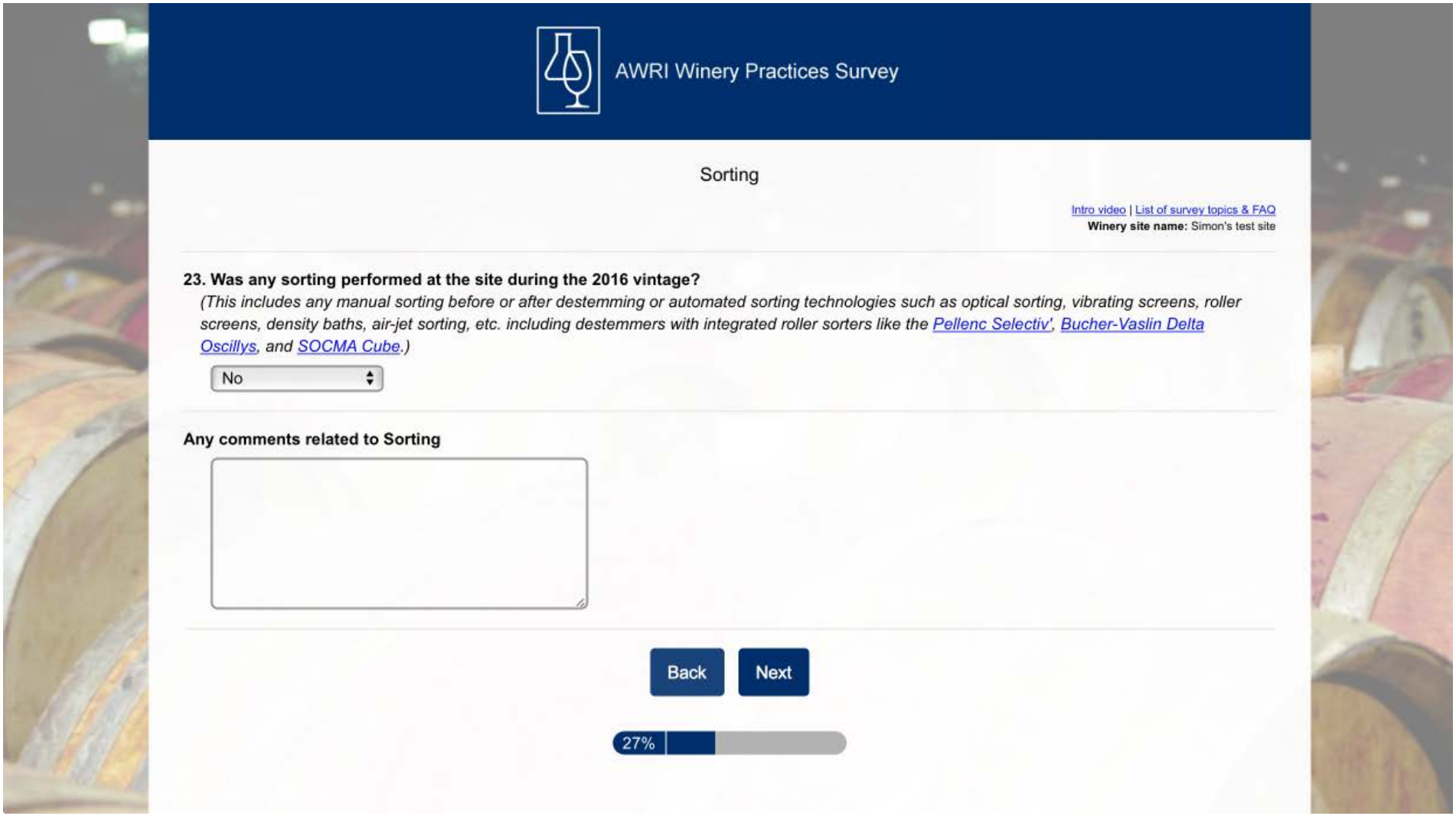
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