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Coinoculation and red wine long maceration Questions/Answers with my winemaking experience

Conference presented during Lallemand Technical Meeting

Lisbon, Portugal, April 2013

If we manage the following microbial situation, no special problem with long maceration and malolactic fermentation with coinoculation yeast-bacteria

Microbial populations evolution (semi-log scale) with alcoholic and malolactic fermentation Good Practices (GP)

SO_2 addition as soon as malic is finished

LAB living population

LAB (Lactic Acid Bacteria)coinoculation

Yeast inoculation

Yeast living population

1 week

Indigenous Lactic Acid Bacteria living population

Indigenous *Brettanomyces sp.* living population

Microbial populations evolution (semi-log scale) with alcoholic and malolactic fermentation Good Practices (GP)

SO_2 addition as soon as malic is finished

LAB living population

ctic Acid Bacteria)coinoculation

Selected yeast active population applies a very intense ecological pressure on indigenous LAB and Brett

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Yeast livi

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Bacter

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Brettanomyces

ving population

Microbial populations evolution (semi-log scale) with alcoholic and malolactic fermentation Good Practices (GP)

SO_2 addition as soon as malic is finished

Drain, press, rack 2 times after 12 and 60-72 hours

LAB living population

LAB (Lactic Acid Bacteria)coinoculation

Long Maceration GP

Yeast inoculation

Yeast living population

1 week

Indigenous Lactic Acid Bacteria living population

Indigenous *Brettanomyces sp.* living population

If we manage this microbial situation,

- Malolactic finishes in liquid phase, after draining, pressing, racking 2 times (after 12 and 60-72 hours): classical MLF Good Practices in liquid phase
- So, we take advantage of both long maceration and MLF good practices with coinoculation
- Without special practices due to the long maceration

As a sensory consequence, with coinoculation

SO_2 addition as soon as malic is finished

Drain, press, rack 2 times after 12 and 60-72 hours

LAB

LAB (Lactic Acid

Long ration

Cleaner More fruit

Cleaner More fruit

Cleaner More fruit

Yeast inocula

Yeast living ation

1 week

Indigenous Lactic Acid Bacteria living population

Indigenous *Brettanomyces sp.* living population

With post-AF LAB (Lactic Acid bacteria) inoculation

SO2 addition

Selected LAB living population

LAB inoculation, post AF

Yeast living population

Yeast inoculation

1 week

Drain, press, rack 2 times after 12 and 60-72 hours

Maceration

Indigenous LAB living population

Indigenous *Brettanomyces sp.* living population

With post-AF LAB inoculation

SO2 addition

Selected LAB active population applies a very intense ecological pressure on indigenous LAB and Brett, but on a much higher population

LAB inoculation post AF

The absence of a selected LAB population leaves an ecological space for indigenous LAB and Brett growth

Selected yeast active population applies a very intense ecological pressure on indigenous LAB and Brett

Drain, press, rack 2 times after 12 and 60-72 hours

Maceration

Indigenous LAB living population

Indigenous *Brettanomyces sp.* living population

With post-AF inoculation

SO2 addition

Selected LAB living population

LAB inoculation, post AF

With extended maceration, very favorable growth conditions for Brett & Co.

Yeast living population

Yeast inoculation

1 week

, press,
times
12 and
2 hours

Maceratio

Indigenous LAB living population

Indigenous *Brettanomyces sp.* living population

As a sensory consequence, with post-AF inoculation

SO2 addition

ed LAB living tion

Clean

Clean?

Clean?

Yeast living population

Yeast inoculation

1 week

Drain, press, rack 2 times after 12 and 60-72 hours

Maceration

Indigenous LAB living population

Indigenous *Brettanomyces sp.* living population

Question #1.

To assure a coinoculation and a long maceration:

Which pH recommendations?

Is it possible?

Which precautions other than pH?

Which sensory changes?

Answer #1

- To assure a coinoculation and a long maceration:
  Which pH recommendations?
  < 3.51 all through maceration
- Is it possible to co-inoculate and make a long maceration?
  Yes, and quite easy with pH around 3.5
- Which precautions other than pH?
  Crush, temperature management (<26-27°C max.), sulfiting GP (<35 ppm added), yeast protection and nutrition.

Be sure to be absolutely sugar-dry during post-alcoholic maceration

Answer #1 (B)

- Which sensory changes?

Classical direct positive effect of coinoculation : more fruit and more balanced tannin-like sensations
+ The prevention effect of coinoculation on “Brett and Co” growth. So cleaner wines with better expression of fruit and less bitterness
+ The effect of possible MLF with the pomace: more complexity, more spicy with certain varieties.
But less direct full fruit. So, it has to be managed in fuction of wine style and markets goals

Question #2.
How to manage LAB inoculation with over-15-days maceration?

Manage Good Practices to reach this situation

SO2 addition

1 week

LAB coinoculation

LAB living population

Yeast living population

Yeast inoculation

15-20 days maceration

Indigenous Lactic Acid Bacteria living population

Indigenous *Brettanomyces sp.* living population

Main Good Practices to reach this situation

- < 3.51 all through maceration
- Coinoculation, AND
- Crush, sulfiting GP (<35 ppm added), LAB friendly yeast strain, yeast protection and nutrition, temperature management (<24-25°C max. during AF, 18-20°C after AF),
- Be sure to be absolutely sugar-dry during post-alcoholic maceration
- Forget many local traditions...

The best option to reach complexity, balance, longevity, and low volatile acidity

- Do a 15-20 days long maceration following the previous GP rather than a longer one (over 20 days) with “artificial” actions (to avoid spontaneous MLF and “Brett and Co”).
- “Artificial” actions =
  - Sulfiting during maceration to prevent malo and Brett growth. SO2 addition blocks many of the looked for reactions of a very long maceration
  - Lysozym addition. Reminder: no action on Brett

Reminder: in a Good Practices strategy, long maceration is only a tool, not a goal. There are very safe and high quality pathways to reach the announced goals for a "very long maceration".
15-20 days maceration + co-inoculation + Dominique Delteil Consultant GP are better than a very long maceration without MLF GP

Question #3.
After a coinoculation, how to manage the end of malolactic fermentation if malic consumption occurs in the presence of the pomace cap ?
Situation 1: sugars are completely consumed before the end of malic acid

Action #1. As soon as sugars are completely consumed:

- **Make a delestage and in the drained wine, lower pH immediately to 3.50 maximum, if necessary.** To go on favoring the selected LAB you co-inoculated
- **Cool the wine to 18°C.** To protect the fruit and avoid harsh tannin-like sensations development
- **If necessary, add 1 g/hl Reduless and 10 g/hl Noblesse or Optilees.** To open the aromas if necessary and to re-balance the colloid matrix if some aggressive sensations appear
- **Pump the juice back to the maceration tank**
- **Make one delestage a day during the 2 following days. Total: 3 delestage in 3 days**

Note: make these 3 recommended delestages even if you normally manage the pomace cap with other techniques (punching down, pumping over, submerged cap, etc.).
Delestage is the only technique drains well the cap.

The action #1, right after alcoholic fermentation, is a key point to have the selected LAB population grow and consume malic in the absence of residual sugar. Then a moderate temperature and an adjusted pH complement this strategy

Action #2. As soon as malic acid is consumed:

- **Immediately : make a delestage. A real one with complete draining !**
- **Adjust pH immediately to 3.50 in the drained wine**
- **Add 50 ppm SO2 in the drained wine**
- **Cool the wine to 18°C maximum.** For some grape varieties it is interesting to lower temperature to 12-14°C during post MLF extended maceration. Better fruit and more secure microbial situation
- **Add 1 g/hl Reduless** (to balance the SO2 addition impact) **and 10 g/hl Noblesse or Optilees** (to rebalance the colloid matrix)
- **Pump the juice back to the maceration tank**

Until final draining and pressing

according to analytical profile and sensory style

- Check Volatile Acidity (VA), Total SO2, pH, residual sugar : 2-3 times a week
- Delestage : at least 2 times a week, eliminating the heavy lees settling at the bottom of the reception tank
- Temperature : 18°C max.
- If tannin-like sensations are aggressive, try a Reduless addition (1 g/hl) and Noblesse (10 g/hl) or Optilees

Draining and pressing according to analytical profile and sensory style

- Drain, press, adding 1g/hl Reduless
- Adjust temperature to 12°C
- Keep press wines separate. Note: after very long maceration, press wines are often of lower quality than free run drained wine
- Rack after 12 hours
- Check pH, Total SO2, VA, sugar. Adjust pH and SO2 if necessary
- Rack again after 48 hours

Brix and malic curves during a co-inoculated yeast - bacteria fermentation

Yeast inoculation

As soon as the pomace cap is formed, coinoculation with selected LAB

Long maceration

Malic acid

Brix

1 week

Brix and malic curves during a co-inoculated yeast - bacteria fermentation

Yeast inoculation

As soon as the pomace cap is formed, coinoculation with selected LAB

Delestages: 3 in 3 days, adjust pH to 3.50

Delestage, adjust pH to 3.50, add 50 ppm SO2, pump back to maceration tank

Drain, press, add Reduless, rack 2 times (12 and 60-72 hours after draining)

Long maceration

24°C max.

18°C max.

Malic acid

10-12°C

Brix

1 week

Situation 2.
Malic acid is already finished before the end of sugar fermentation: see question #7

Question #4.
How to manage LAB inoculation if micro-oxygenation is necessary on structured reds?

Question #4.
How to manage LAB inoculation if micro-oxygenation is necessary on structured reds?

Micro-ox supplier question !

Question #4.
How to manage
Micro-oxygenation with a
Good Practices managed MLF?

Lallemand & DDC's question !

Question #4.
How to manage
Micro-oxygenation with a
Good Practices managed MLF?

Do not confuse between
means and objective !

Micro-oxygenation Good Practices with a structured red wine

1 month | 1 month | 1 month

Yeast inoculation

As soon as the pomace cap is formed, coinoculation with selected LAB

Drain, press, rack 2 times

O_2 dose

Stir regularly the lees

Racking #3, sulfiting GP

Stir regularly the lees

Malic acid

Brix

Micro-oxygenation after MLF + sulfiting = 1/10th of pre-MLF dose

20 days maceration

Stop

Racking #4

Exemple of micro-oxygenation doses, for a very structured red, expressed in mg/Liter/Month

60

50

40

30

Malic acid

Brix

0

Stop

3

2

Micro-oxygenation after MLF + sulfiting = 1/10th of pre-MLF dose

1.5

1.0

Exemple of micro-oxygenation doses, for a very structured red, expressed in mg/Liter/Month

60

50

40

30

Malic acid

Brix

0

Stop

3

2

Micro-oxygenation after MLF + sulfiting = 1/10th of pre-MLF dose

1.5

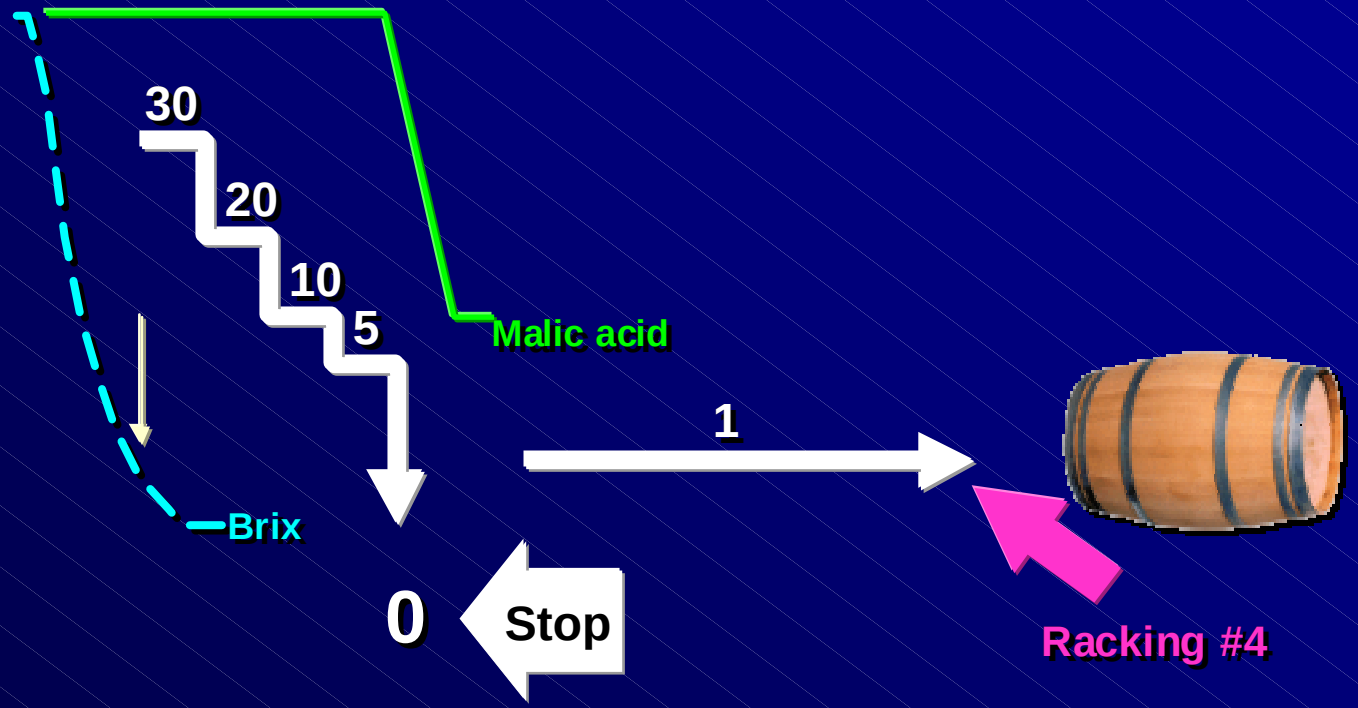
1.0

Micro-oxygenation Good Practices = optimization of the tool.

Not its maximalization pushed by some micro-ox gurus !

Dominique Delteil Consultant's good practices.

Oxygen doses expressed in mg/Liter/Month



Why?

Dominique Delteil Consultant's good practices.

Oxygen doses expressed in mg/Liter/Month

Reduless 1 g/hl

Reduless 1 g/hl

Reduless 0.5 g/hl

30

20

10

5

Malic acid

1

Brix

0

Stop

Racking #4

Noblesse 10 g/hl

Noblesse 10 g/hl

Noblesse 10 g/hl

Dominique Delteil Consultant's good practices.

Oxygen doses expressed in mg/Liter/Month

Reduless 1 g/hl

Reduless 1 g/hl

Reduless 0.5 g/hl

30

20

10

5

Malic acid

1

Stop

Early use of Reduless and Noblesse directly do better and more complete colloidal actions than higher micro-ox doses.
Such micro-ox doses are sufficient

Early use of Reduless and Noblesse allows to build and stabilize early a highly concentrated colloidal matrix.
A shorter micro-ox duration with a lower dosage is sufficient to complement the matrix stabilization

#4

Noblesse 10 g/hl

Question #5.
Must we stop micro-oxygenation when MLF has started?

Answer #5.
YES

Why?
When to stop?

Brix and malic curves during a co-inoculated yeast - bacteria fermentation

Yeast inoculation

As soon as the pomace cap is formed,
coinoculation with selected lactic acid bacteria

<30% of malic consumed

Very safe micro-ox

Stop micro-ox

1 week

Brix

Malic acid

Another absolute key point: as soon as malic is consumed, racking and sulfiting

Yeast inoculation

As soon as the pomace cap is forme

coinoculation with selected lactic a ria

Racking & Sulfiting

Very safe micro-ox

Stop micro-ox

Malic acid

1 week

Brix

Brix and malic curves during a co-inoculated yeast - bacteria fermentation

Yeast inoculation

As soon as the pomace cap is formed,
coinoculation with selected lactic acid bacteria

50% of malic consumed

Safe micro-ox

Stop micro-ox

Malic acid

1 week

Brix

Another absolute key point: as soon as malic is consumed, racking and sulfiting

Yeast inoculation

As soon as the pomace cap is forme

coinoculation with selected lactic a ria

Racking & Sulfiting

Safe micro-ox

Stop micro-ox

Malic acid

1 week

Brix

Brix and malic curves during a co-inoculated yeast - bacteria fermentation

Yeast inoculation

As soon as the pomace cap is formed,
coinoculation with selected lactic acid bacteria

Close to the edge of abyss micro-ox !

90% of malic consumed

Malic acid

Stop micro-ox

1 week

Brix

Another absolute key point: as soon as malic is consumed, racking and sulfiting

Yeast inoculation

As soon as the pomace cap is forme

coinoculation with selected lactic a ria

Racking & Sulfiting

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sumed

Close to the edge of abyss micro-ox !

Malic acid

Stop micro-ox

1 week

Brix

Brix and malic curves during a co-inoculated yeast - bacteria fermentation

Yeast inoculation

As soon as the pomace cap is formed,
coinoculation with selected lactic acid bacteria

Malic acid

Oops !
Too late !

1 week

Brix

Stop micro-ox

Brix and malic curves during a co-inoculated yeast - bacteria fermentation

Yeast inoculation

mace cap is formed,

h selected lactic acid bacteria

Never give oxygen to an *Oenococcus* living population once it has completely consumed malic: when it starts consuming intensely citric acid and some residual sugars there is a very high risk of Volatile Acidity (VA) and negative flavors production

Oops !
Too late !

lic

Stop micro-ox

1 week

Brix

Question #6.
Is there a maximum amount of oxygen if I want to make micro-ox during the MLF ?

Answer #6.
NO

Answer #6.

Polyphenolic concentration of the wine, stylistic goals and temperature pilot the amount of oxygen added.

MLF pilots when to start, stop, start again Micro-ox., along with sulfiting and rackings

Question #7.

After a coinoculation, during a long red maceration,

if MLF starts and finishes before the end of alcoholic fermentation, is it possible to go on macerating? Which particular precautions?

Answer #7.
Well, well, well, oh well !!!!

Don’t miss a single point !

- As soon as malic is finished, immediately : a delestage. A real one with complete draining !
- Adjust pH immediately to 3.45 in the drained juice
- Add 30 ppm SO2 in the drained juice
- Cool the juice to 18°C
- Add 1 g/hl Reduless (to balance the SO2 addition impact) and 10 g/hl Noblesse or Optilees (to help the living yeast finish the AF and rebalance the colloid matrix)
- Pump the juice back to the maceration tank

Don’t miss a single point (2)

- After a pumping over, check volatile acidity (VA), and Total SO2
- Everyday a delestage until the end of the sugars
- Keep temperature at 18°C
- Check everyday the remaining sugar level, the VA, the pH.
- If VA is rising, drain immediately, correct pH again to 3.40 and add another 20 ppm SO2. Rack 12 hours later to eliminate heavy lees (as they combine and bound SO2) and to homogenize well the SO2

After the end of alcoholic fermentation, if VA is still correct and stable

- Make a delestage
- Check pH is below 3.50. If not, adjust it
- Add 20 ppm SO2 in the drained juice
- Keep temperature around 18°C
- Add 1 g/hl Reduless (to balance the SO2 addition negative sensory impact) and 10 g/hl Noblesse or Optilees (to rebalance the colloid matrix affected by the SO2 addition)
- Pump the juice back to the maceration tank

Until final draining and pressing

according to analytical profile and sensory style

- Check VA, Total SO2, pH : 2-3 times a week
- Delestage : at least 2 times a week, eliminating the heavy lees settling at the bottom of the reception tank
- Temperature : 18°C max.
- If tannin-like sensations are aggressive, try a Reduless addition (1 g/hl) and Noblesse (10 g/hl) or Optilees

Question #8.

Sometimes we have sugar released after the end of alcoholic fermentation in case of long maceration.

Is there a risk if I already inoculated with bacterias (VA ?)

Answer #8.
YES

The best strategy: avoid as much as possible this situation !

Key points to avoid Question #8, that is to avoid sugar release from the pomace after alcoholic is finished

- **Crush the fresh grapes.** To avoid any unopened berry during maceration
- **Add maceration enzymes.** To ease the diffusion of juice and sugar during the active Alcoholic Fermentation and to amplify delestage efficiency in draining and slighly pressing the pomace
- **Good Practices for a steady and complete AF .** Adapt yeast strain chioice, protection, and nutrition to juice sugar concentration

Key points to avoid Question #8 (2)

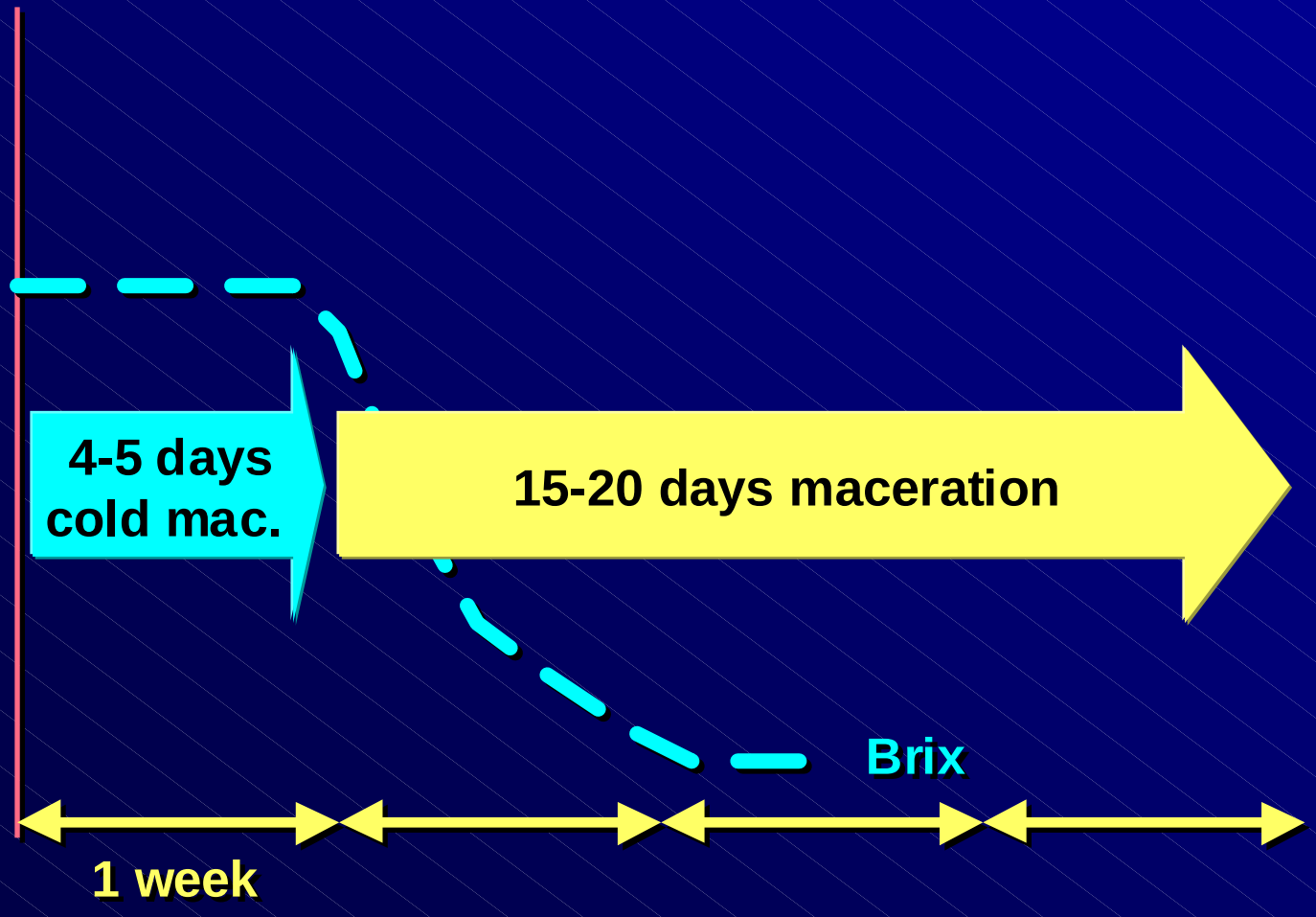
- **Regular Delestages.** At least 3 delestages a week during active AF : to drain perfectly the pomace juice and slightly press the berries, assuring a complete drainage of sugar

Question #9.

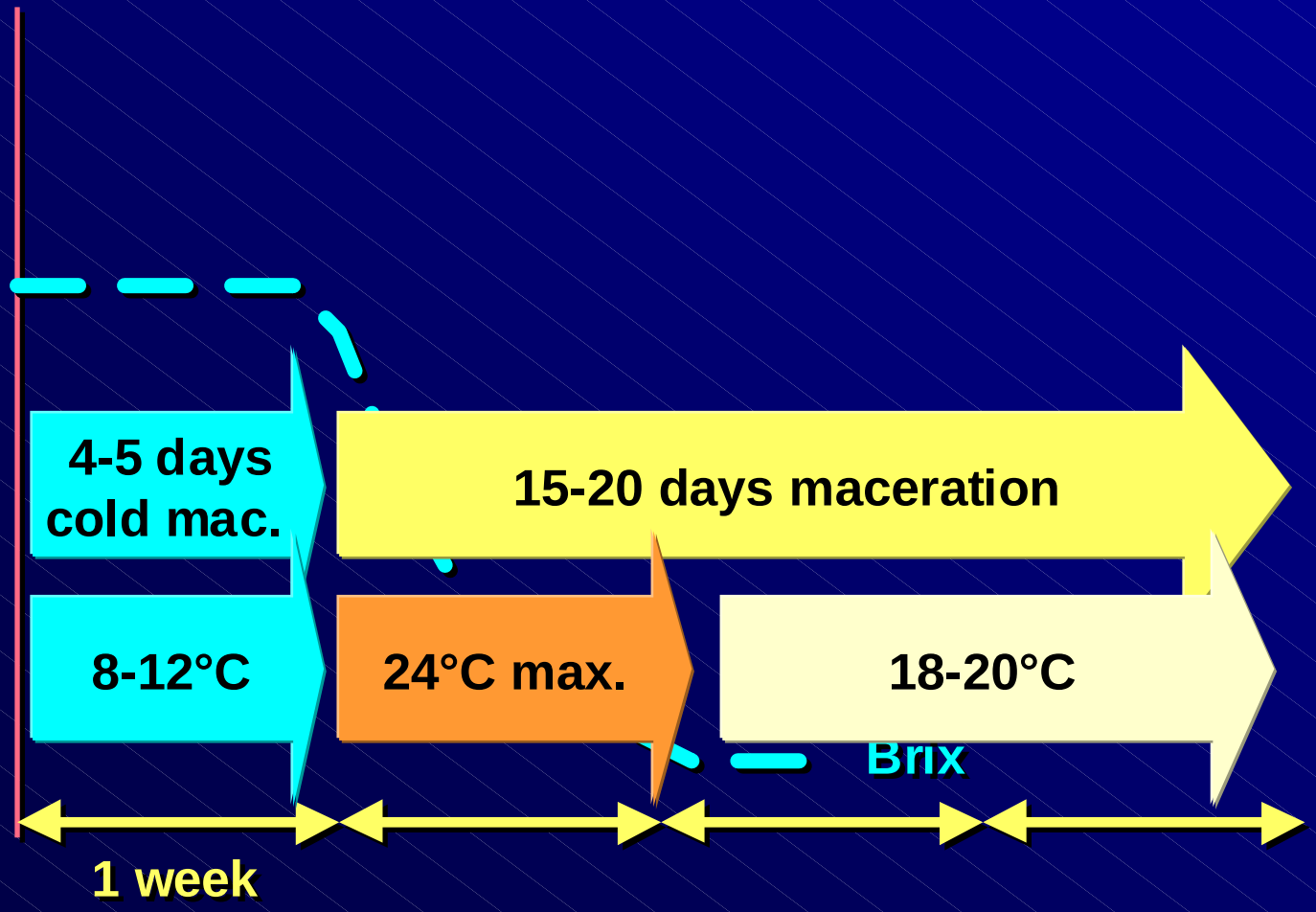
Cold maceration. When to inoculate the bacteria if I aim for co-inoculation strategies?

Answer #9.
Apply cold maceration Good Practices
+
Long maceration Good Pactices

Brix curve during cold maceration + classical maceration procedure applying Good Practices



Temperature management during cold maceration + classical maceration procedure



Actions during cold maceration + classical maceration procedure

Temperature adjustment, destem, crush, pH adjustment, SO2 (30 ppm max.), maceration enzymes, yeast protection, yeast inoculation, Optired

Fermaid O

4-5 days cold mac.

15-20 days maceration

8-12°C

24°C max.

18-20°C

Brix

1 week

Actions during cold maceration + classical maceration procedure

Temperature adjustment, destem, crush, pH adjustment, SO2 (30 ppm max.), maceration enzymes, yeast protection, yeast inoculation, Optired

Fermaid O

To ecologically limit the risks of apiculated yeast growth during the cold maceration : An absolute key-point is to immediately inoculate with a protected (GoFerm Protect), temperature adapted selected yeast strain.

1 week

Malic curve during a co-inoculated yeast - bacteria fermentation, after a cold maceration

Temperature adjustment, destem, crush, pH adjustment, SO2 (30 ppm max.), maceration enzymes, yeast protection, yeast inoculation, Optired

Fermaid O

As soon as the pomace cap is formed, coinoculation with selected lactic acid bacteria

4-5 days cold mac.

15-20 days maceration

8-12°C

24°C max.

18-20°C

Brix

Malic acid

1 week

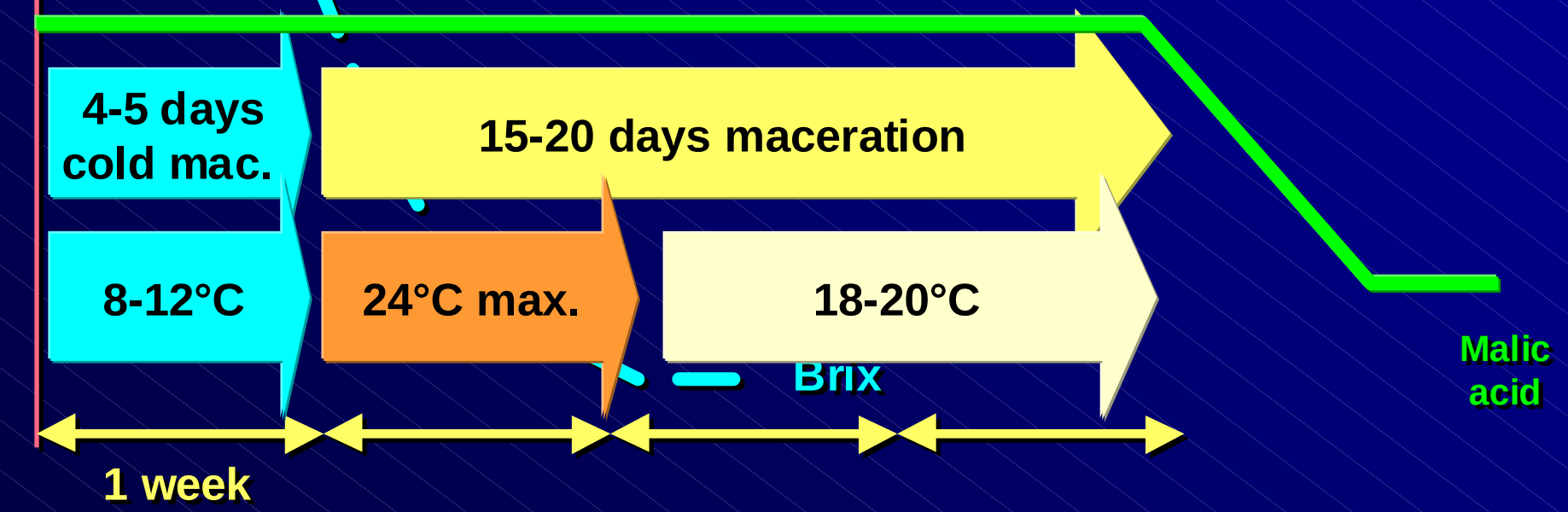
Dominique Delteil Consultant

Malic curve during a co-inoculated yeast - a fermentation, after a cold maceration

Note :
Cold pre-fermentation maceration does not change the coinoculation good practices:
As soon as the pomace cap is formed, coinoculation with selected lactic acid bacteria

nent, destem, crush, pH adjustment, SO2 (30
on enzymes, yeast protection, yeast

s soon as the pomace cap is formed, coinoculation with selected lactic acid bacteria



Post maceration and post MLF actions during a co-inoculated Cold + classical extended maceration

Temperature adjustment, destem, crush, pH adjustment, SO2 (30 ppm max.), maceration enzymes, yeast protection, yeast inoculation, Optired

Fermaid O

As soon as the pomace cap is formed, coinoculation with selected lactic acid bacteria

Drain, press, rack 2 times

Stir regularly

4-5 days cold mac.

15-20 days maceration

8-12°C

24°C max.

18-20°C

Brix

Malic acid

1 week

Racking #3, sulfiting GP

Special procedure for high quality Pinot Noir, with a full fruit style goal

High Quality full fruit Pinot Noir GP

Temperature adjustment, destem, crush, pH adjustment (3.3-3.4), SO2 (30 ppm max.), maceration enzymes, oak blocks, yeast protection, yeast inoculation RC212, Optired

Fermaid O

As soon as the pomace cap is formed, coinoculation with selected LAB

Drain, press, rack 2 times (12 and 72 hours after draining)

Stir the lees regularly, keep pH <3.40

Racking #3, sulfiting GP

Malic acid

4-5 days cold mac.

10-12 days maceration

8-12°C

20°C max.

18°C

16°C

1 week

High Quality full fruit Pinot Noir GP

Tempe
max.),
RC212

adjustment (3.3-3.4), SO2 (30 ppm
st protection, yeast inoculation

ess, rack 2 times (12
ours after draining)

Note 1:
For full fruit high quality Pinot Noir,
it is not recommended to macerate over
12-15 days.
Longer maceration duration
will bring more dry spicy and dryer tannin
sensations,
the opposite of the pre-fermentation
maceration goals

Stir the lees regularly,
keep pH <3.40

Racking #3,
sulfiting GP

Malic acid

4-5 days
cold mac.

10-12 days
maceration

8-12°C

20°C max.

18°C

16°C

1 week

High Quality full fruit Pinot Noir GP

Temperature adjustment, destem, crush, pH adjustment (3.3-3.4), SO2 (30 ppm max.), st protection, yeast inoculation RC212

Note 2 :
To achieve a full bodied, full fruit Pinot Noir with such temperature and maceration duration, an intense delestage (2 a day) and punching down (3 to 4 a day) program is the recommended procedure

ess, rack 2 times (12 hours after draining)

Stir the lees regularly, keep pH <3.40

Racking #3, sulfiting GP

Malic acid

4-5 days cold mac.

10-12 days maceration

8-12°C

20°C max.

18°C

16°C

1 week

High Quality full fruit Pinot Noir GP

Temperature adjustment, destem, crus… …om
max.), maceration enzymes, oak block…
RC212, Optired

Fermaid O

As soon as the pomace cap is formed, coinoculation with selected LAB

Dr… ar…

Note 3 :
As soon as significant malic degradation is detected, lower temperature to 16°C in order to protect the full fruit character.
Such a temperature change won't stop a well going on malolactic fermentation.

…g #3,
…mitting GP

…c acid

4-5 days cold mac.

10-12 days maceration

8-12°C

20°C max.

18°C

16°C

1 week