Second Pruning as a strategy to delay maturation in cv. 'Touriga Nacional' in the Portuguese Douro Region

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INTRODUCTION

Temperature increase, associated to climate change is causing significant effects on agricultural systems. In this scenario, viticulture in southern European regions has been identified as vulnerable, due to the negative impacts on yield and grape composition, which reduce the quality and typicity of wine.

Crop management practices must therefore be able to rely on more trustworthy weather models for forecasting harmful events and field tools.

Different strategies are currently being tested to mitigate these climate changes, that includes forcing vine regrowth, or crop forcing, aimed to delay grape maturation, to a period in which temperatures are more favourable for fruit ripening.

OBJECTIVES

This work aims at evaluating a second pruning (also known as crop forcing; CF) in crop development, yield and berry composition, of an important cultivar of Douro Region, growing under Mediterranean conditions.

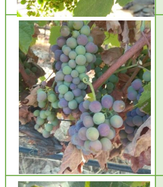
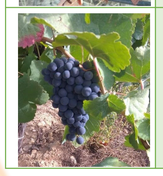
METHODOLOGY

- ✓ Trials were conducted in 2019 and 2020, in a commercial vineyard with a sandy loam soil, located at Douro Superior sub-region, Portugal.
- ✓ Touriga Nacional cv. used in the study was planted in 2014, grafted in 196-17 Cl rootstock. Eight adjacent rows were selected to form a randomized block design. All plants were manually pruned, after leaf fall.
- ✓ Experimental design considered three treatments: a control (CF0), with vines grown under conventional practices; and two forcing dates, 15 days after fruit set (CF1) and 30 days after fruit set (CF2).
- ✓ Second pruning consisted of hedging the growing shoots to five nodes and removing all the laterals, leaves and clusters, to force the budbreak of the dormant bud developed in the current season.

RESULTS

Main phenological stages and CF delay

Table 1: Main phenological stages, days of occurrence and delay compared to CF0 in Touriga Nacional variety during 2019 and 2020 vintage.

Phenological stages/Treatment			CF0	CF1	CF2
	Budburst (C stage)	2019	March 28th	June 16th (+80 days)	July 9th (+103 days)
		2020	March 10th	June 15th (+76 days)	June 30th (+82 days)
	Flowering (I stage)	2019	May 18th	July 12th (+54 days)	July 25th (+67 days)
		2020	May 8th	July 9th (+62 days)	July 21st (+74 days)
	Fruit set (J stage)	2019	May 22nd	July 16th (+65 days)	August 6th (+85 days)
		2020	May 19th	July 14th (+56 days)	July 28th (+70 days)
	Veraison (M stage)	2019	August 6th	September 17th (+41 days)	October 1st (+84 days)
		2020	July 17th	September 20th (+65 days)	October 6th (+83 days)
	Harvest (N stage)	2019	September 25th	October 22nd (+26 days)	November 5th (+38 days)
		2020	September 8th	October 19th (+40 days)	29th October (+50 days)

Influence of CF on Yield

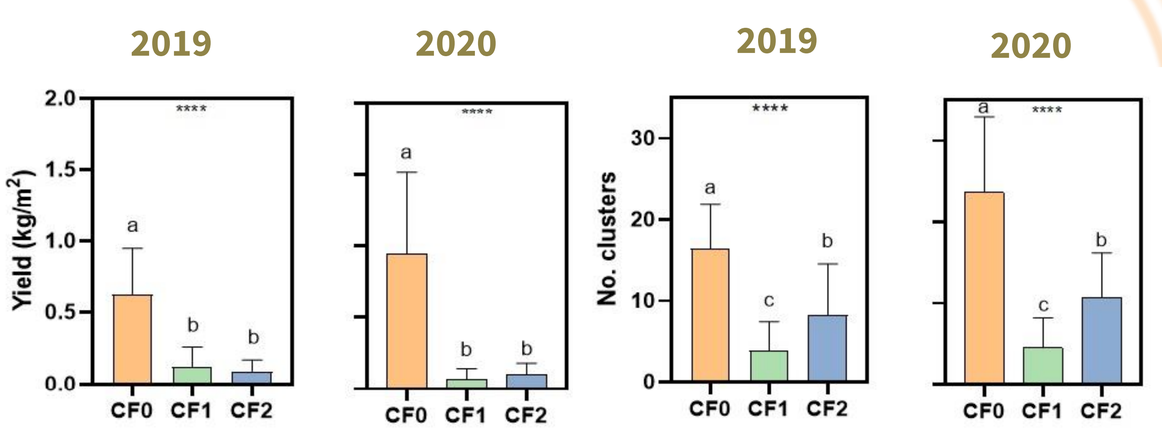


Figure 1: Influence of CF on yield in 2019 and 2020 vintages.

Figure 2: Influence of CF on clusters number in 2019 and 2020 vintages.

Influence of CF on Must Quality

Table 2: Influence of CF in total soluble solids (TSS); pH; titratable acidity (Tot. Acid.); total phenolic content (Tot. Phen.) and colour intensity (Col. Int.) in 2019 and 2020 vintages.

Year	Treat.	TSS (°Brix)	pH	Tot. Acid. (g/L)	Tot. Phen. (A.U.)	Col. Int. (nm)
2019	CF0	23,72±1,04 a	3,84±0,07 a	3,58±0,35 c	14,46±3,68 a	3,53±0,87 a
	CF1	25,31±0,59 a	3,50±0,05 b	5,45±0,45 b	14,01±0,84 a	2,68±0,32 a
	CF2	20,14±1,60 b	3,10±0,04 c	9,58±0,89 a	14,73±3,10 a	2,68±0,51 a
2020	CF0	23,52±1,65 a	3,83±0,10 a	3,86±0,32 c	11,52±1,97 b	2,90±0,56 a
	CF1	22,91±1,12 a	3,40±0,03 b	6,89±0,52 b	15,70±2,58 a	2,54±0,30a
	CF2	12,93±5,18 b	3,31±0,08 b	9,30±0,93 a	17,01±3,27 a	2,64±0,56 a

DISCUSSION AND WAY FORWARD

- Shift on canopy regrowth may have caused a debt on **carbohydrate reserves**;
- **Fruit did not ripen properly** when vines were **forced 30 days** after fruit set due to cooler temperatures and first autumn rains;
- With CF: **Less clusters**, **lower pH**, **higher acidity**, same content of **organic acids** and **phenolics**;
- CF should only used when supported by **long term predictions** and **decision support systems**;
- **CF** seems more appropriated **to vigorous varieties** to control yield: not suitable for Douro Region and Touriga Nacional cultivar;
- CF is associated with **increase in production costs** – to be performed only when the production of **premium wines** (in low amounts) of very high commercial value is envisaged;
- CF may prove to be useful after the occurrence of **extreme weather events**.

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