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Grapevine double cropping: a reality, not a myth

>>> The main drawback of the forcing vine regrowth technique is the loss of yield[1]. In order to avoid such loss of yield and not eliminate the primary clusters already formed on the primary shoots, it is possible to force the development of the latent buds of the fifth and sixth nodes, while maintaining the clusters on the main shoots. In this way, the yield of the forced buds can be added to the normal or primary yield of the shoots. In this article, experiments carried out on Grenache, Tempranillo and Maturana Tinta varieties in La Rioja (Spain) are presented. <<<

Figure 1. Left: Detail of the highest axillary shoot which was trimmed, and development of the latent bud. Center: forced cluster (green) and primary cluster (coloured) on Grenache. Right: forced cluster (green) and primary cluster (coloured) on Maturana Tinta.

In June 2020 an interesting article was published with the title: "Double Cropping in *Vitis vinifera L.* Pinot Noir: Myth or Reality?"[2] in which this question is addressed through a one-year experiment using one cultivar grown in pots. This article aims to show how obtaining a double harvest from vines is not a myth, but a reality by describing field experiments on Grenache, Tempranillo and Maturana Tinta varieties in La Rioja.

In recent years, different trials involving the forcing of new buds on vine have been conducted with the aim of delaying grape ripening by up to two months, as a strategy for grapevine adaptation to climate change[1, 3]. The main problem with bud forcing techniques is loss of production. A second drawback is the manual work needed to remove the axillary shoots, leaves and clusters from the main shoots to favour the development of the newly formed latent buds. Furthermore, in terms of its practical application, the elimination of the grapes already developed on the main primary shoots is not well-accepted by growers.

In previous studies on the severe trimming of shoots to delay ripening[4, 5] we verified that, in addition to the development of axillary shoots, the development of some latent buds was frequent, specifically those of the node or two higher nodes, of which the already developed axillary shoots had also been trimmed; thus, there was not so much inhibition of the newly formed latent bud. In these studies, the clusters of the forced buds were not taken into account and were left on the vine, as is done with the clusters produced by axillary shoots (known, in Spanish, as "racima").

The technique in the present study was carried out over two years and consisted of performing severe trimming at the end of flowering, leaving six nodes on the primary shoots, as well as the leaves, axillary shoots and existing clusters; that is, maintaining the yield of the main shoots. The next step involved forcing the development of one or two latent buds located on the 6th and 5th nodes, thereby obtaining a double crop: the usual crop of that year and the crop which was prepared in the latent bud for the following year (Figure 1, center and right). At this time, there is still no endodormancy in the latent buds and, if we eliminate the inhibition by correlation of the axillary shoots (as the temperature is favourable), these buds will rapidly sprout and develop[6].

When trimming on a horizontal plane, the axillary shoots of the nodes in position six and five are also trimmed, thus breaking inhibition due to the developed laterals, (Figure 1, left). It is possible to perform a second trimming at the same level ten days later to cut the developed secondary shoots (laterals), or to remove them by hand.

To summarise, the studied treatments are:

➔ F1. Trimming of the developed primary shoots at the end of flowering and on a horizontal plane above node number six, and second trimming at the same height about ten days later.

➔ F2. Trimming at the end of flowering above node number six, and removal by hand of the two upper axillary shoots.

➔ F3. Trimming at the end of flowering above the sixth node, and removal by hand of all the axillary shoots.

➔ C. Control, without any trimming.

➔ No significant differences were found between the different trimming treatments.

Our hypothesis is that in this way we can achieve a first crop corresponding to the main clusters, delaying ripening by about 10/15 days compared to the control and having reduced the leaf area by trimming, which is in agreement with studies on shoot trimming[4, 5]. In addition, we can get a second crop from the forced latent buds whose ripening will be delayed by up to a month and a half with respect to the control.

Results

Delays of about 13 days for the main clusters and of about 35 days for the clusters of the forced shoots were observed for grape ripening measured at around 22-23 ºBrix, when comparing the forced treatments to the control (Table 1).

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Table 1. Effects of forcing treatments on vine phenology. *The experiment on the Grenache variety is located in Badarán, at 620 m a.s.l. and the experiments on the Tempranillo and Maturana Tinta varieties are located in Logroño, at 370 m a.s.l.

Year/Variety/Treatment*	Anthesis		Veraison		Harvest	
	Primary	Forced	Primary	Forced	Primary	Forced
2019 Grenache						
Unforced control	10 Jun	-	21 Aug	-	10 Oct	-
F1	10 Jun	1 Aug	30 Aug	30 Sep	23 Oct	15 Nov
F2	10 Jun	1 Aug	30 Aug	30 Sep	23 Oct	15 Nov
F3	10 Jun	1 Aug	30 Aug	30 Sep	23 Oct	15 Nov
2019 Tempranillo						
Unforced control	4 Jun	-	1 Aug	-	8 Sep	-
F1	4 Jun	15 Jul	5 Aug	4 Sep	22 Sep	10 Oct
F2	4 Jun	15 Jul	5 Aug	4 Sep	22 Sep	10 Oct
F3	4 Jun	15 Jul	5 Aug	4 Sep	22 Sep	10 Oct
2019 Maturana Tinta						
Unforced control	6 Jun	-	2 Aug	-	8 Sep	-
F1	6 Jun	19 Jul	6 Aug	5 Sep	23 Sep	12 Oct
F2	6 Jun	19 Jul	6 Aug	5 Sep	23 Sep	12 Oct
F3	6 Jun	19 Jul	6 Aug	5 Sep	23 Sep	12 Oct

The yield of the forced shoots was about 30 % of that of the primary shoots and represented around 1 kg per vine. There are significant differences between the control and the forcing treatments in terms of leaf area/yield ratio, which, despite being lower for the forcing treatments, has values of around 0.9-1.0 m^2/kg (Table 2).

Table 2. Effects of forcing treatments on yield components. For each variety, the different letters within a column show significant differences between values according to the Tukey test (P = 0.05). *The experiment on the Grenache variety is located in Badarán, at 620 m a.s.l. and the experiments on the Tempranillo and Maturana Tinta varieties are located in Logroño, at 370 m a.s.l.

Year/Variety/ Treatment*	Forced Shoots per Primary Shoot (n°)	Clusters per vine (n°)		Cluster weight (g)		Yield per vine (kg)		Leaf Area/Yield (m^2/kg)
		Primary	Forced	Primary	Forced	Primary	Forced	
2019 Grenache								
Unforced control	-	19.3	-	201.5	-	3.89	-	1.43 a
F1	1.2	18.5	19.3	174.0	61.6	3.22	1.19	0.90 b
F2	1.3	19.8	20.2	192.9	60.0	3.82	1.20	0.85 b
F3	1.3	20.1	19.7	185.0	51.8	3.72	1.02	0.95 b
2019 Tempranillo								
Unforced control	-	16.5	-	201.8	-	3.33	-	1.86 a
F1	1.1	17.2	19.4	181.4	66.0	3.12	1.28	1.13 b
F2	1.0	18.0	17.7	178.1	75.1	3.20	1.33	1.20 b
F3	1.1	16.8	18.5	189.3	60.5	3.18	1.12	1.07 b
2019 Maturana Tinta								
Unforced control	-	17,3	-	199.4	-	3.45	-	1.51 a
F1	1.1	15.8	18.7	204.4	50.8	3.23	0.95	0.92 b
F2	1.2	16.5	19.2	178.2	54.7	2.94	1.05	0.96 b
F3	1.1	17.1	19.1	177.2	48.2	3.03	0.92	0.94 b

Further studies are needed to evaluate the long-term effects of grapevine forcing and newly formed latent bud development, especially on the refill of nutritional reserves of the perennial organs (roots, etc). The leaf area/yield ratio in the forcing treatments seems to be enough to maintain the reserve status. According to Zheng *et al.* (2017)[5], the leaf area/yield ratios of 0.9-1.0 m^2/kg indicate that vines possess sufficient leaf area to achieve berry maturation and to accumulate reserves for the following year. On the other hand, Poni *et al.* (2020)[2] studied the effects of this technique on the fertility of basal buds and found that forcing did not reduce their fertility.

Conclusions

By appropriately applying the forcing regrowth technique to Grenache, Tempranillo and Maturana Tinta varieties, it is possible to obtain a second crop from the forced buds, which can be added to the first crop from the main primary shoots. The second crop represents about 30 % of the primary crop, which is about 1 kg/vine in our study conditions. Relative to the unforced control, the primary crop matures about 13 days later and the secondary crop about 35 days later.

Although longer-term studies are needed, the resulting leaf area/yield ratio of this double cropping indicate that it was sufficient for the grapes from the two crops to properly ripen, and it can be assumed that carbohydrate reserves are normally refilled for the next year.

This is a first contribution to the literature demonstrating the possibility of obtaining a double crop in temperate viticulture regions under field conditions and for three different grapevine varieties. It is interesting to note that the forcing is done before the latent bud endodormance on green primary shoots (i.e., not on lignified shoots).

Ideas for possible practical application

First of all, the trimming technique is very simple and can be done mechanically on a horizontal plane. The second produced crop can be harvested or, if it is not worth harvesting, it can be left on the vine, as is done with the clusters produced by the axillary shoots. The second harvest can be done mechanically. As pointed out by Poni *et al.* (2020)[2], this technique will obviously provide better results when shoot vigour is high enough; in the case of shoots of low vigor, the development and the leaf area of the new forced shoots will be insufficient. ■

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