BEHAVIOUR OF TWO TRAINING SYSTEMS FOR MECHANICAL PRUNING COMBINED WITH DIFFERENT NITROGEN FERTILIZATIONS ON CV. COLOMBARD

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Abstract:

Context and purpose of the study – Today winegrowers involved in mechanical winter pruning are applying this viticultural technique on two main training systems, the free cordon, appearing to be the more efficient, and the trellised vertical shoot positioning (VSP) system. The main reasons for maintaining the trellis are generally due to common habits in vineyard management, risk of wind damage for the shoots, or risk of decrease in photosynthesis potential. The aim of the study was to assess the effects of the two training systems on vine. In addition, different nitrogen fertilization levels were applied on the two systems to evaluate the best combination to achieve yield and grape quality.

Material and methods – Free cordon and spur pruned VSP system were compared during 3 vintages, from 2016 to 2018, on a rainfed cv. Colombard, planted in 2012 in Gascony vineyard, south-west of France. The trial was run on a young plot, planted in 2012, with a production goal of around 15 tons per hectare. Four strategies of nitrogen fertilization were applied on each system including soil mineral supplies (40N and 80N/ha) and foliar spraying (25N/ha) combined with green manure on each treatment (control). Total foliar area, yield, pruning weight, nitrogen and water status were controlled each year. Grapes composition at harvest and wine quality also allowed to compare the different treatments.

Results – The results showed different behavior of the vine according to the training systems. Total leaf area and yield were significantly lower for the free cordon system each of the tree years, regardless of nitrogen fertilizations. With the same leaf-fruit ratio, in 2017 and 2018, the free cordon grapes contained less sugar than VSP grapes. To explain some of these differences, discussion will take place around plot's age and on plant development delay due to higher height of the supporting wire for free cordon system. Also, in our conditions, the rainfed free cordon development appeared to be very dependent on the height and period of shoot trimmings. The different fertilization strategies induced significant results on chlorophyll index of the leaves every year and on yeast assimilable nitrogen of grapes after the second year. The berries from the control treatment presented the lowest concentration of nitrogen and the foliar treatment the highest. But, the nitrogen fertilization supplies did not modify yield and pruning weight for both systems. The three-year treatments were not sufficient to induce major differences in these cases.

Keywords: Free cordon, Vertical Shoot Positioning, nitrogen fertilization, Colombard

1. Introduction.

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MATERIAL AND METHODS

Free cordon and spur pruned VSP system were compared during 3 vintages, from 2016 to 2018, on a rainfed cv. Colombard, in Gascony vineyard, south-west of France. The trial was run on a young plot, planted in 2012, with a production goal of around 15 tons per hectare. Four strategies of nitrogen fertilization were applied on each system including soil mineral supplies (40N and 80N/ha) and foliar spraying (25N/ha) combined with green manure on each treatment (control). Total foliar area, yield, nitrogen on leaves (Dualex® sensor) and water status were controlled each year. Grapes composition at harvest allowed to compare the different treatments.

RESULTS

Total leaf area (fig1) and yield (fig2) were significantly lower for the free cordon system compared to VSP system each of the tree years, regardless of nitrogen fertilizations. With the same total leaf area to weight fruit ratio, in 2017 and 2018, the free cordon grapes also contained less sugar than VSP grapes (fig3).

Two main reasons to explain the differences:

- the plot was planted in 2012 and suffered not enough vigor to install a sufficient canopy in the first year of production (2015) although the yield was high (1.3 kg/m²). This deficit of vigor was prolonged on the next years
- in our conditions, with a rainfed vineyard, the height of the first trimming was too short to insure an efficient leaf area to weight fruit ratio at veraison. Here the choice was to avoid plant upturning. Dry summer conditions stopping plant growth impacted total leaf area development. Thus, the opened canopy of free cordon system, considered more efficient for light interception, was nethertheless not sufficient compared to vertical trellising system.

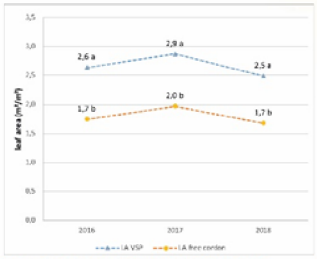

Figure 1 : evolution of the total leaf area on VSP and free cordon systems

Figure 2 : evolution of the yield on VSP and free cordon systems

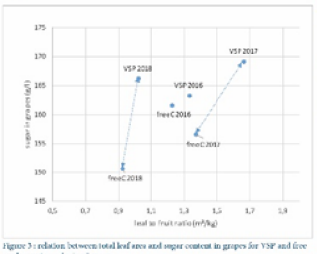

Figure 3 : relation between total leaf area and sugar content in grapes for VSP and free cordon systems during 3 years


Image 1 : Training system with mechanical pruning

The different fertilization strategies induced significant results on chlorophyll index of the leaves every year (Nitrogen Balance Index measured by Dualex® sensor) and on yeast assimilable nitrogen of grapes after the second year (tab1). The berries from the control treatment presented the lowest concentration of nitrogen and the foliar treatment the highest. But, the nitrogen fertilization did not modify neither yield or pruning weight for both systems. The three-year treatments induced no major differences in this plot.

Table 1 : Nitrogen Balance Index (Dualex® sensor) on leaves at bunch closure (BBCI16) and Yeast assimilable nitrogen on grapes at harvest (BBCI16) measured on the two training systems and four different strategies of nitrogen fertilization.

	Nitrogen Balance Index at bunch closure			Yeast assimilable nitrogen at harvest (mg/l)		
	2016	2017	2018	2016	2017	2018
VSP						
control	9,5 b	10,5 b	7,9 c	155	153 b	91 b
foliar 25N/ha	9,3 b	11,1 a	8,5 b	194	218 a	135 a
soil 40N/ha	10,1 a	11,2 a	8,7 ab	181	182 ab	106 ab
soil 80N/ha	10,6 a	11,4 a	9,2 a	215	202 a	129 a
Pr > F	**< 0,0001**	**0,002**	**< 0,0001**	0,102	**0,018**	**0,012**
free cordon						
control	9,1 b	10,5 b	8,8 a	142	166 b	118 b
foliar 25N/ha	9,8 a	10,4 b	9,1 a	218	278 a	175 a
soil 40N/ha	9,7 a	11,1 a	8,2 b	188	176 b	142 ab
soil 80N/ha	10,0 a	11,0 a	9,2 a	201	178 b	139 ab
Pr > F	**0,003**	**0,009**	**0,007**	0,074	**0,005**	**0,041**

CONCLUSION

Nitrogen supply was not the main driver of vigor on this experimental plot. For canopy management on free cordon with mechanical winter pruning system, the height of the first trimming is essential to install sufficient canopy early in season, especially on non-irrigated vineyard which is very dependent of climatic conditions.

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