TRANSFORMATION OF A VINEYARD TRELLISED AS "PARRAL" (cv. PINOT NOIR) TO THE "Y" bm INTA SYSTEM IN THE AREA OF LUJAN DE CUYO, MENDOZA

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Key words: trellis systems; Y bm INTA; "parral"; canopy microclimate; enological quality.

Summary

The test was conducted in a vineyard (cv. Pinot negro) of the department of Lujan de Cuyo located in the Mendoza River oasis, Argentina. The objective is to improve the ripening process of the grapes through a trellis system that optimizes the potentiality of the area. With this goal, the transformation of the vineyard trained by "parral" trellis to the "Y" bm INTA trellis system was carried out. The different treatments corresponded to: A) Bilateral transformation for the "Y" bm INTA (Lyre trellis); B) Unilateral transformation for the "Y" bm INTA (Semi-lyre) and C) Control ("parral" trellis).
By means of the use of "Y" bm INTA trellis system, the microclimates conditions were modified within the canopy and particularly in the area of the grape bunches. This allowed to improve the process of the grape ripening, increasing its enological potential resulting in a better organoleptic quality of their wines. Furthermore, this produces a lower production of grapes in the first and second vintage with a tendency to compensate it in the third vegetative cycle.
The new conduction through jointed arms allows the mechanization of the most important tasks of the crop (pre-pruning, defoliation, harvest).
Therefore, the transformation of a "parral" to the divided "Y" bm INTA trellis system allows to improve the potential of the land to develop higher quality grapes.

Resumé

L'essai a été réalisé dans un vignoble (cv. Pinot Noir) situé dans le département Lujan de Cuyo, placé à l'oasis du fleuve Mendoza, Argentine. L'objectif du travail est d'améliorer la maturation des grappes à travers d'un système de conduite qui permisse optimiser l'expression des potentialités de la zone. Avec ce fin, on a réalisé la transformation d'un vignoble conduit en parral au système Y bm INTA. Les différents traitement correspondent à : A) Transformation Bilatéral du vignoble par le Système Y bm INTA (Système en Lyre) ; B) Transformation Monolatéral par le Système Y bm INTA (Demi Lyre) et C) Témoin (parral).
Par moyen de l'application du système de conduite Y bm INTA on a modifié les conditions microclimatiques à l'intérieur de la canopée, spécialement dans la zone des grappes. Donc, on a améliore le procès de maturation des grappes en incrémentant son potentiel œnologique qui se traduit en un meilleur qualité œnologique de ses vins. En plus, on produit une diminution du rendement dans la première et la deuxième vendange, avec une tendance de compensation à partir du troisième cycle végétative.
La nouvelle conduite, à travers de bras articulés, permet la mécanisation des labeurs plus importantes du cultive (pretaille, effeuillage, vendange, etc.).
En conséquence, la transformation d'un parral, au système de canopée divisé Y bm INTA, permet incrémenter l'expression du potentiel du terroir en augmentant la qualité des baies.

INTRODUCTION

The best known vine trellis system in Argentina has been traditionally the "parral" trellis (continuing canopy system of horizontal development) engaging almost 65% of the cultivated surface and,

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following in importance, the vertical shoot-positioned trellis with 23% (Estadísticas INV, 2000). In the province of Mendoza the situation is similar, the "parral" trellis reaches approximately 55% while the rest principally trained in vertical shoot-positioned (44%). The "parral" trellis presents certain inconveniences regarding the enological quality of the grapes produced, in the handling of crops and their operative costs (Miranda & Battistella, 2004). The main deficiencies are: shaded canopy with little sunlight on the bunches, higher costs in sanitary treatments and additional ways of canopy management (conduction in bilateral cordons, buds remove, defoliation, etc.)

The "Y" bm INTA trellis system has been developed and evaluated in the Agricultural Experimental Station Mendoza (del Monte et al., 1999, 2000) during 4 years in cultivars such as Cabernet-sauvignon and Chardonnay. It's about a canopy system divided into two plans (one fixed and the other articulated) that allows to handle the crops through an integral mechanized of different labours, especially the harvest and the pruning (Carbonneau et al. 2000; del Monte et al. 2001). It has been shown that the divided canopy trellis system can produce grapes with a high enological potential owing to a considerable increase in the exposed leaf surface per hectare (Carbonnaeu, 1989; Smart & Robinson, 1991) and a better spatial distribution of foliage and bunches which contributes to favouring the microclimatic conditions within the canopy (Carbonneau, 1980; Shaulis et al, 1966; Smart et al, 1986). On the other hand, this better exposition of the foliage induces to a moderate water stress contributing to an increase of the enological quality of the grapes raising the polyphenol synthesis due to better exposition of the bunches (Carbonneau,1986; Katerji et al. 1986; Katerji et al. 1994).

The object of this work is to improve the ripening of the grapes through a trellis system ("Y" bm INTA) that optimises the potentiality of the area allowing, at the same time, an integral mechanization of vineyard tasks.

MATERIALS AND METHODS

Characteristics of vegetative material

The tests was carried out in the vineyard originally trained in "parral" trellis (cv. Pinot Negro) situated in Lujan de Cuyo, in the experimental fields of EEA Mendoza. The layout of the plantation is 2.50m between the plants and the rows. The age of the plants is approximately 15 years. There were aged plants with flexible stems that allowed them to re-conducted within the new structure without cultivars changes. The transformation was done by bending and locating the stems of the vines horizontally up the trellises of the new structure (0.70m above the ground). The pruning of the first year was mixed: 2 spurs and 2 canes per vine (approximately 25 buds per vine) while in the following year they left 4 canes and 2 spurs. The conduction of the control ("parral" trellis) must conform to the normal cultivation practices in "parral", with mixed pruning by four spurs and four canes ready in the form of "H". The watering was by means of flood irrigation without gradient and applying the same amount of water to all the treatments.

Experimentation variables

Treatment A: Transformation to the bilateral alternative of "Y" bm INTA trellis system (Lyre)
Treatment B: Transformation to the unilateral alternative of "Y" bm INTA trellis system (Semi-lyre)
Treatment C (control): Traditionally handling of the "parral" (without any transformation)

Experimental Design

The experimental design corresponds to comparative plot matches, the experimental plot has a surface area of 750 m2. The statistic analysis was done through the comparison of means (t.test $P \lesssim 0,05$) by the statistics system STATHGRAPHICS version 5.0 for WINDOWS

Determinations

The transformation of the trellis system was carried out in 2000, and during 2001, 2002 and 2003 the evaluations of 15 plants per plot were shown.

Yield components

Before the harvest, the number of bunches per plant was determined as well as the average weight and the production per plant.

Vegetative expression

The potential exposed leaf area (SFEp) was determined following the Carbonneau method (1995). The total leaf area was calculated through the SFT average per shoot (this is determined by three leaves per shoot) and using a leaf area meter Model Li-3000 A. Weekly during 2003 it showed the length of 10 shoots per plot and its rate of daily growth (cm/day). During winter it showed the number of shoots per vine and the weight of the pruning to calculate the Ravaz Index.

Canopy microclimate

The photosynthetically active radiation (PAR) at the level of bunches showed in 3 years of study was done with a line quantum sensor model "Licor-191SA". The rod was located horizontally in the area of the bunches and determinations were made at veraison and ripening along the whole day. During the cycle 2003/04 once balanced and adapted the plants to the new system, the measuring of the temperature and humidity inside the canopy and the temperature within the bunches was held. They used sensors HOBO© HO8-004-02, which took the measurements every 30 minutes during 24 hrs using the program Box Car version 3.7 for Windows. The sensors were placed at the interior of the canopy at height of bunches in the stage of maturity of the grapes.

Yield quality

A sample was harvested of 100 kg per treatment to be elaborated in the Experimental Winery of the Enological Studies Centre of the EEA Mendoza. While a taste panel determined the organoleptic quality of the wines through sensitive comparative and descriptive analysis.

RESULTS AND DISCUSSION[1]

Yield components

The lower production observed with the treatments A and B in the first two years (Table 1) was mainly due to a lower number of bunches and not to their weight. There is a tendency to compensate from the third cycle expecting less difference between treatments. This could not be confirmed owing to the damage produced by the hail storm passed one month before harvest in the last cycle of measurements.

Vegetative expression

The SFEp rose significantly with both alternative forms of transformations, while the total leaf surface (SFT) doesn't support differences (table 2). This indicates that even if the three treatments present the same leaf surface, treatments A and B have better foliage percentage directly exposed to radiation, while control (C) possess higher quantity of leaves and bunches shaded.

The final length of the shoots reached in 2003 (Figure 1) by the "parral" (80 cm approximately) is inferior to the length that is considered optimal (100 cm) for a good maturity of bunches (Smart and Robinson, 1991). Also, the control show a worse rate of growth (Figure 2) than the others two treatments and the vegetative growth is interrupted to two and three weeks before. The treatments A and B stop the growth at beginning of veraison, so reducing the competence between the vegetative apex and the bunches, allowing the production of high quality wines (Carbonneau & Casternan, 1989). According to these authors, the trellis system should allow an important vegetative development without shoots overlapping and later at the beginning of veraison the growth stops. Finally they pointing out that the vineyards trained by Lyre present these characteristics. Gaudelliere and Carbonneau (1986) obtained similar results relating to a more appropriate vegetative expression of the Lyre regarding other trellis systems. The Ravaz Index of control (C) establishes that it is about plants exposed to great levels of production relating to its leaf surface (Martinez de Toda, 2001). With the time, this overproduction might weaken the crops through the years reducing the build up of reserves substances in the trunk and roots (Murisier, 1996). Treatments A and B went down in value according to this Index in the first year, showing plants with an excessive vegetative expression in respect to its

[1] Measurements correspondents to 2003/2004 season were interrupted the 16/01/04 for a hailstone storm damage. As a consequence, this year was not possible to determinate bunches weight and leaf area.

production. This was in part due to the pruning formation in the first year, where the thick elements (arms and part of the trunk) of old vine structure were structed in order to adapt it to the new trellis system. The following year these two treatments showed a more balanced relationship between both vegetative and productive parts.

Canopy microclimate

The Hobo sensors were placed on the 06/01/04 at 07:00hs in the morning and then taken out the following day at the same time. There were no differences in the amount of relative humidity and the temperature in the area of bunches or the temperature within the bunches (no data). As long as the light microclimate (PAR) determined through the integrative bar along the day significantly differentiate the three treatment in the three measurement seasons. The treatment A (Y bm bilateral) presented a higher reception of light along the whole day (figure 3), while the treatment B (Y bm unilateral) behaved in an intermediate way. The treatment C was subjected to less radiation in the area of bunches. The light microclimate is intimately related with the thermal microclimate, for this reason it was expected that this better reception of PAR means an increase in the foliage temperature and in the bunch temperature. In our research this hasn't been observed, probably owing to the punctual character of the determinations of the Hobo sensors.

Enological quality of production

In the first two year the evaluation through sensitive analysis distinguished (figures 4 and 5) the treatments A and B from the control for better concentration, colour, tannic intensity and aromatic intensity detected in the wine; furthermore they were equally preferred in the tests of comparative preference. The evaluation of the wines produced in 2004 has not been able done, usually owing to the damage caused by the hail storm.

CONCLUSION

By means of application of the "Y" bm INTA system the microclimate conditions (especially the light reception) within the canopy and particularly in the area of the bunches improved, which allowed to improve the ripening of the grapes.

A decreased production of grapes was produced in the first and second vintage owing to a less number of bunches. A tendency of compensation from the third vegetative cycle was observed. There was an increase in potential exposed leaf surface (SFEp) and grapes with better enological potential were obtained; witch showed a higher quality organoleptic of its wines.

Therefore, the transformation of a "parral" to the system of divided canopy Y bm INTA allows to improve the potentiality of the land, raising the quality of the grapes.

Nowadays, deeper research is being carried out about the physiological performance of the vines in each of the trellis systems in experimentation as well as their adaptability managed and handling at a commercial level.

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TABLES AND FIGURES

Table 1. Yield components from the "parral" (cv.Pinot Negro) transformed by the "Y" bm INTA trellis system by application Unilateral and Bilateral of the mobile arm, Lujan de Cuyo.

Period	2001/02			2002/03			2003/04		
	A (Ybm Bilateral)	B (Ybm Unilat.)	C ("parral")	A (Ybm Bilateral)	B (Ybm Unilat.)	C ("parral")	A (Ybm Bilateral)	B (Ybm Unilat.)	C ("parral")
Yield (kg . vine^{-1})	8.07 a	8.44 a	11.91 b	7.87 a	9.42 a	11.20 b	3.46 a	3.60 a	4.16 a
Number of bunches per vine.	47.73 a	51.07 a	66,07 b	38.87 a	48.77 b	59.71 c	35.8 a	32.8 a	44.06 b
Average bunches weight (gr)	168.13 a	164,93 a	184,40 a	207.43 a	194.04 a	184.98 a	101.57 ab	110.60 a	82.49 b

In the rows, the values following the letters show no difference between the statistics. (t.Test, P>0,05)

Table 2. Vegetative production from the "parral" (cv. Pinot Negro) transformed by the "Y" bm INTA trellis system by application Unilateral and Bilateral of the mobile arm, Lujan de Cuyo.

Period	2001/02			2002/03			2003/04		
	A (Ybm Bilateral)	B (Ybm Unilat.)	C ("parral")	A (Ybm Bilateral)	B (Ybm Unilat.)	C ("parral")	A (Ybm Bilateral)	B (Ybm Unilat.)	C ("parral")
Pruning weight (kg .vine^{-1})	1.94 a	2.40 a	1.31 b	1.17 a	1.42 a	1.19 a			
Number of buds per vine	602.15 a	585.37 a	543.57 a	467.3 a	565.9 b	635.5 b	/	/	/
Average leaf area (cm²)	167.08 a	171.60 a	174.74 a	132.4 a	123.6 ab	118.7 b	*	*	*
Total leaf surface (SFT) (m^2)	9.58 a	10.12 a	10.05 a	6.1 a	7.1 a	7.2 a	*	*	*
Ravaz Index	4.42	4.00	10.27	7.47	7.60	9.82			
SFEp (m^2)	3.06 a	3.10 a	1.97 b	/	/	/	/	/	/

In the rows, the values following the letters show no difference between the statistics. (t.Test, P>0,05)
*Not determined by the damage caused by hail.
/Not determined

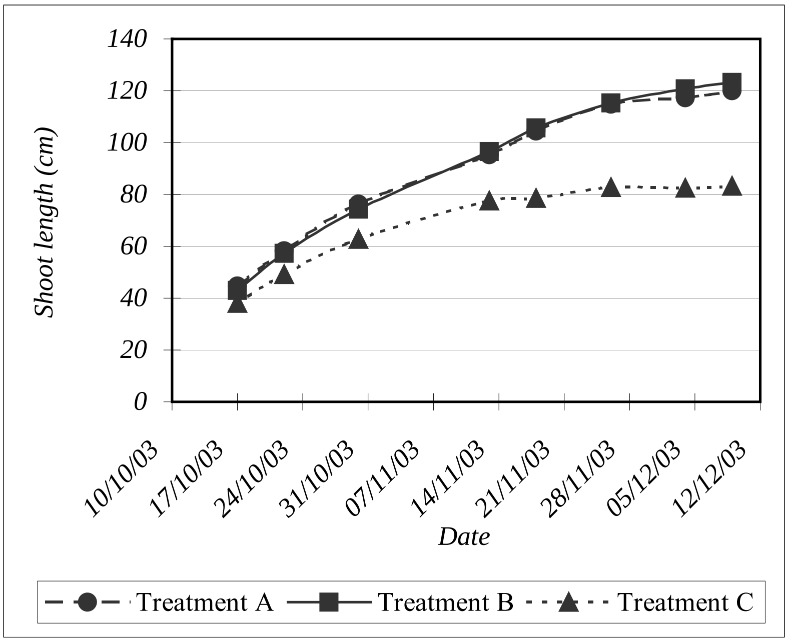

Figure 1: Progress of the shoots length in the “parral” (cv. Pinot Negro) transformed by the “Y” bm INTA trellis system by application Unilateral and Bilateral of the mobile arm, Lujan de Cuyo, period 2003/04.

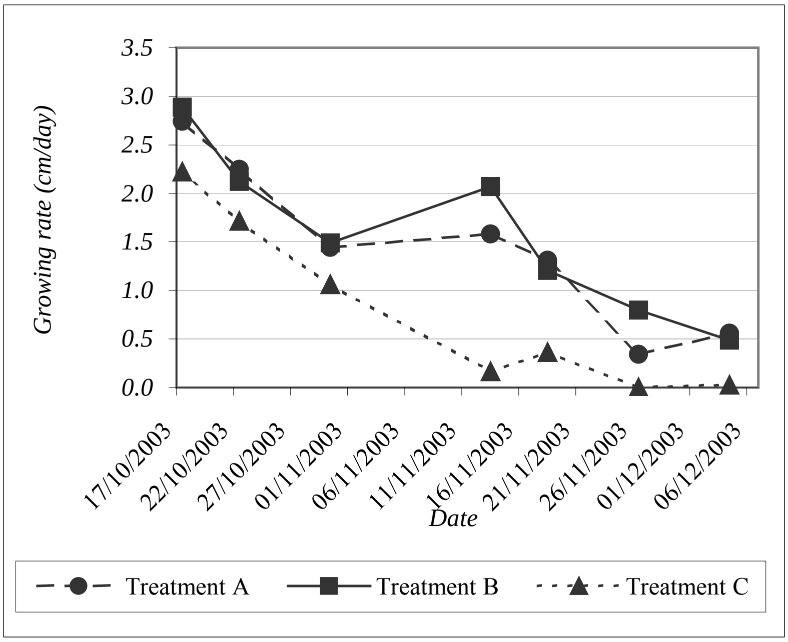

Figure 2: Progress of the growing rate with the "parral" (cv.Pinot Negro) transformed by the "Y" bm INTA trellis system by application Unilateral and Bilateral of the mobile arm, Lujan de Cuyo, period 2003/04.

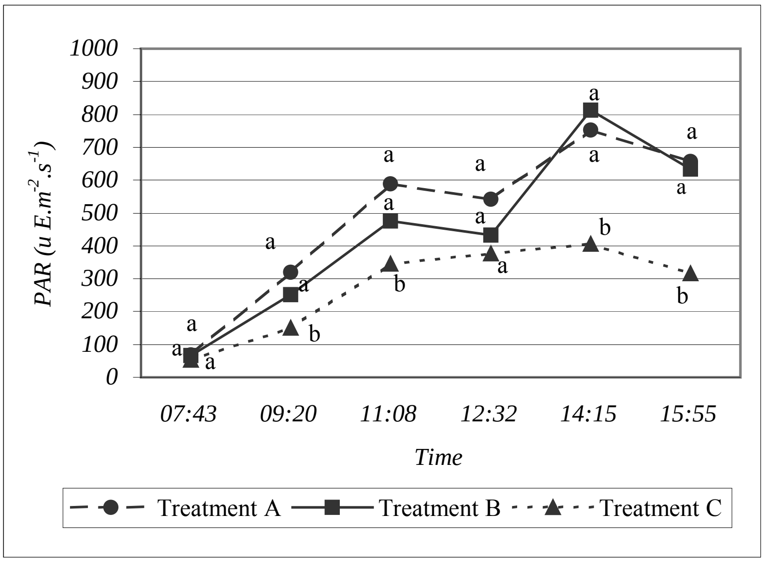

Figure 3: Photosynthetically active radiation (PAR) received by the “parral” (cv.Pinot Negro) transformed by the “Y” bm INTA trellis system by application Unilateral and Bilateral of the mobile arm, Lujan de Cuyo, 06/01/2004. At the same time, the points marked with same letters show no difference between the statistics (t.Test, P>0,05).

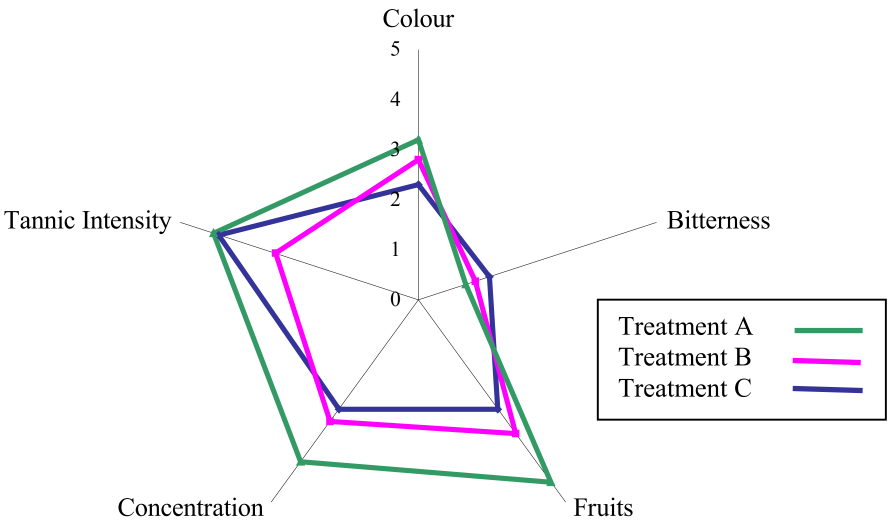

Figure 4: Organoleptic evaluation (descriptive analysis) of the wines produced with the grapes coming from the "parral" (cv. Pinot Negro) transformed by the "Y" bm INTA trellis system by application Unilateral and Bilateral of the mobile arm, Lujan de Cuyo, period, 2001/02.

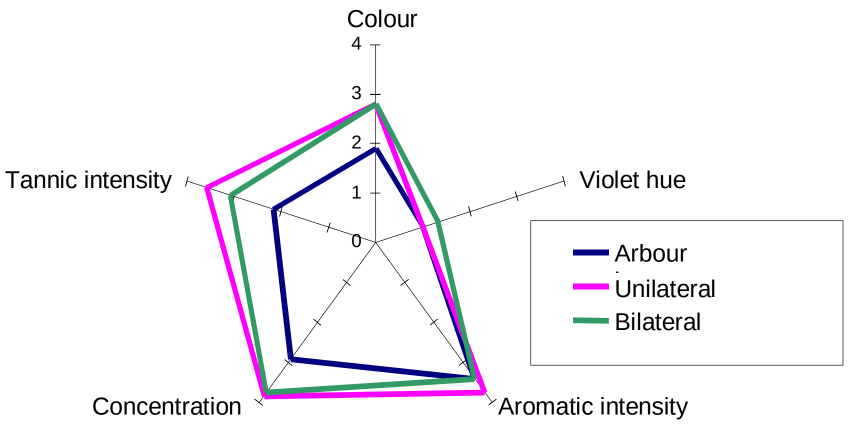

Figure 5: Organoleptic evaluation (descriptive analysis) of the wines produced with the grapes coming from the "parral" (cv. Pinot Negro) transformed by the "Y" bm INTA trellis system by application Unilateral and Bilateral of the mobile arm, Lujan de Cuyo, period 2002/03.