

DETERMINATION OF BUD FERTILITY AS A SIMPLE METHOD FOR THE DETERMINATION OF HARVESTING VOLUME IN *VITIS VINIFERA* L. CV TANNAT, USING TWO PRUNING SYSTEMS

DÉTERMINATION DE LA FERTILITÉ DES BOURGEONS COMME UNE MÉTHODE SIMPLE POUR ESTIMER LE VOLUME DE RÉCOLTE POUR LE *VITIS VINIFERA* L. CV TANNAT, GRÂCE À DEUX SYSTÈMES DE TAILLE

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Summary : Bud fertility was estimated in two commercial vineyards of *Vitis vinifera* cv. Tannat in the southern region of Uruguay; it was carried out in two periods: 1983-1986 (essay A) and 2001,2002,2003 (essay B). The information about bud fertility and yield obtained in the essay A was used as a historical series. The essay B begun in the year 2001. In the two essays, two pruning systems were evaluated: Guyot and cordon de Royat.

The pruning system has a very important influence on the bud fertility and therefore on the yield. The Guyot type of pruning, showed for all the years involved in the essay a tendency to higher yields, if it is compared to the Cordon de Royat type of pruning.

The study of the bud fertility, yield and the pruning type for a vineyard during a number of years, can be used as a tool to predict the harvest volume.

Résumé : La fertilité des bourgeons a été estimée dans deux vignobles au sud du pays, sur deux périodes: 1983-1986 (essai A) et 2001-2003 (essai B). Les données de fertilité de l'essai A ont été utilisées comme série historique de référence. L'essai B est installé depuis l'année 2001 sur une vignoble implanté en 1988. Dans les deux cas, les études de fertilité et de rendement ont été faites en comparant la taille Guyot au cordon de Royat.

La taille utilisée s'est révélée avoir une influence importante sur la fertilité et donc sur le rendement.

L'étude, sur plusieurs années, de la fertilité, et du rendement selon la taille peut être utilisée comme un outil d'estimation du volume de récolte. De cette façon il est possible de prévoir les pratiques culturales, et aussi de planifier les volumes de production envoyés pour vinification pendant les vendanges.

Mots clés : *Vitis vinifera* cv. Tannat, taille, fertilité du bourgeon, prévision de récolte.

Key words : *Vitis vinifera* cv. Tannat, pruning, bud fertility, yield forecasting.

INTRODUCTION

The main characteristic that relates a variety to the pruning system is the bud fertility, understanding the bud fertility as the number of inflorescences per shoot. The varieties that show high fertility in the basal buds, can be pruned using the Cordon de Royat pruning. On the other hand, other varieties show a rising fertility from the basal to the fourth or fifth bud, in this type of varieties the Guyot pruning shows better agronomical behavior (HUETE, 2000).

The bud fertility is often expressed as the mean number of inflorescences per bud. The bud fertility is determined the year before, when the process of bud induction is carried out, and when some factors such as climate, light, temperature and cultural practices have an important influence.

The number of inflorescences per bud has also a strong genetic origin, this one may be the cause why different varieties grown in the same environment could express different bud fertility (HUGLIN, 1958).

This genetic influence causes a variation on the bud fertility depending on the position where the bud is located, it has been observed how the bud fertility increases from the basal buds to the buds located over the superior part of the shoot. For the conditions of Uruguay, FERRER *et al.* (1992) working with 4 varieties of *Vitis vinifera*, found differences in bud fertility depending on the position of the bud on the shoot and also on the year.

The behavior of the variety from the point of view of the bud fertility, is an important tool for the determination of the cultural practices to be carried out on the vineyard, for example, training system, type and intensity of pruning, etc. (CHAMPAGNOL, 1984; COLAPIETRA, 1987; FERRER, 1988).

BOUBALS (1991) indicates that when the cordon de Royat pruning system was carried out, the yields were lower than when the Guyot pruning system was used on the same variety, and leaving the same number of buds per hectare.

In our conditions it was determined that the variety Tannat, has low bud fertility in the basal buds; it has also been observed an increasing fertility from the basal to the fourth or fifth range. For this reason it is considered that Guyot type of pruning is suitable for this variety in order to guarantee sufficient yields.

For the conditions of the South of Uruguay, vineyards of Tannat that have been pruned to Guyot, have shown in several years too high yields. This situation has a negative influence over the quality of wine, so it is important when using this type of pruning and in years in which the yield is considered excessive, to lower the expected yield and obtain a production of quality (GONZALEZ NEVES and FERRER, 2000; FERRER and GONZALEZ NEVES, 2001)

On the other hand, the mean number of clusters of a variety in a particular year, can be considered as a first approach in order to determine the potential of production (May 1961, in HUGLIN and SCHNEIDER). This annual estimation is an important tool for the management of the firm; because it provides valuable information for the organization of the cultural practices to be held in the vineyard in order to obtain a production with good enological characteristics, plan of the harvesting and organization of the vine vault.

MATERIALS AND METHODS

The essays were carried out in two commercial vineyards of *Vitis vinifera* cv Tannat in the southern part of Uruguay.

On the essay A, the bud fertility was evaluated during the year 1983 to 1986. The results obtained were used as an historical mean for this variety. The rootstock used in the vineyard was SO4 and the training system was the espalier or vertical trellis. Plants on the essay A were planted at 2,5 meters between rows and 1,25 meters between plants (3 200 plants per hectare). Two pruning systems were used: Guyot and cordon de Royat (called Royat), and the pruning was made taking into consideration to leave the same number of buds per hectare in both pruning systems and around 60 000 buds/hectare.

The essay took place over thirty plants per treatment that were distributed on three contiguous rows. Real bud fertility was determined counting the number of clusters per each bud range, when the vineyard was over the 17 stage of the scale proposed by Eichorn and Lorenz.

Harvesting took place at technological maturity, and the production in each one of the thirty plants included on the treatment. Mean production per plant was estimated and then the production per hectare was calculated.

The essay B begun in the year 2001, on a vineyard planted in 1988, the rootstock used was SO4 and the training system was an open Lyre. Plants were planted using a distance of 3,2 meters between rows and 0,9 meters between plants (3 472 plants per hectare). The same two pruning systems were evaluated (Guyot and the Cordon de Royat). Thirty plants per treatment were considered, distributed at random over four rows. Pruning was made leaving the same number of buds per plant in the two pruning systems (18 buds per plant, or 6,2 buds per square meter).

For the determination of the bud fertility in the last two years, 10 plants were taken at random for each pruning system. Bud fertility determination was carried out when the vineyard was over the 17 stage of the scale proposed by Eichorn and Lorenz. At this time, all buds that have been left at pruning time were observed and their fertility estimated taking into account the range of each one of buds considered.

The production per bud rank was weighted in each one of the ten plants included on each treatment. Mean production per plant was estimated and then the production per hectare was calculated.

RESULTS AND DISCUSSION

The pruning system used showed a strong influence on the yield (GONZALEZ NEVES and FERRER, 2001). The main cause is due to the low fertility shown in the basal buds of the cv. Tannat, as it has been reported by FERRER *et al.* (1992); and for others varieties by CHAMPAGNOL (1984); COLAPIETRA (1987); BOUBALS (1991).

The pruning system and the range of the bud, have a strong influence on the bud fertility. On the three years of study included in the essay B, the variation on the bud fertility followed the same tendency observed in the historical series (essay A). In the case of the Guyot pruning, an increase of the bud fertility has been observed in relation to its rank; this fact agrees with observations made by FERRER *et al.* (1992), GONZALEZ NEVES *et al.* (2001) (table I).

As shown in the table I, the difference observed on the bud fertility in the first two ranks (B1, B2), between the two pruning is important, as observed by GONZALEZ NEVES (2001). The table I also shows that for the same bud rank (1 and 2), Royat pruning has lower values of bud fertility than the ones observed in the Guyot pruning. The effect of the year also seems to be more important when the pruning system used is the Royat. This could be due to microclimatic conditions of the lower parts of the shoots.

The bud fertility has a strong genetic influence and it is also affected by the environment (Huglin and SCHNEIDER, 1986; FERRER *et al.*, 1992). The differences between years, and pruning systems can also be observed in the figure 1.

When using the Royat pruning, the yields per hectare obtained were lower in all the years of the study. The reductions in the yield per hectare comparing this pruning system with the Guyot, was for the historical series (1983/1986) in the order of 33 %. In the year 2001 the yield reduction was of the 18 %, and for the year 2002 the reduction in the yield was not so important and was 7 % (table II).

The lower fertility of the buds left when Royat pruning was carried out, has a strong influence on the reduction of the yield observed, when this pruning system is compared to the Guyot. This situation has been reported by FERRER *et al.* (1992) and GONZALEZ NEVES (2001).

Taking as a data base and a basis of comparison, the values of bud fertility and yield for the two pruning systems, and for the historical series (1983/86) and the years 2001, 2002, 2003, an objective evaluation of the potential of production of the variety can be estimated, as expressed by May 1961, reported by HUGLIN and SCHNEIDER.

Although this method for the estimation of the harvesting volume is not too accurate, it has the advantage of being a simple method that can also be used early in

Table I - Mean bud fertility per rank, considering Guyot and Royat pruning systems for different years.
Fertilité moyenne des bourgeons en fonction du rang, avec les tailles Guyot et Royat sur différentes années.

	Royat		Guyot					
	B1	B2	B1	B2	B3	B4	B5	B6
1983/86	0,8	1,3	1,35	1,62	1,9	1,95	1,77	1,95
2001	0,91	1,21	2,31	1,62	2,12	2,07	1,93	1,62
2002	1,1	0,6	1,05	0,7	1,05	1,43	1,49	1,5
2003	0,96	0,90	0,89	1,12	1,56	1,33	1,63	1,20

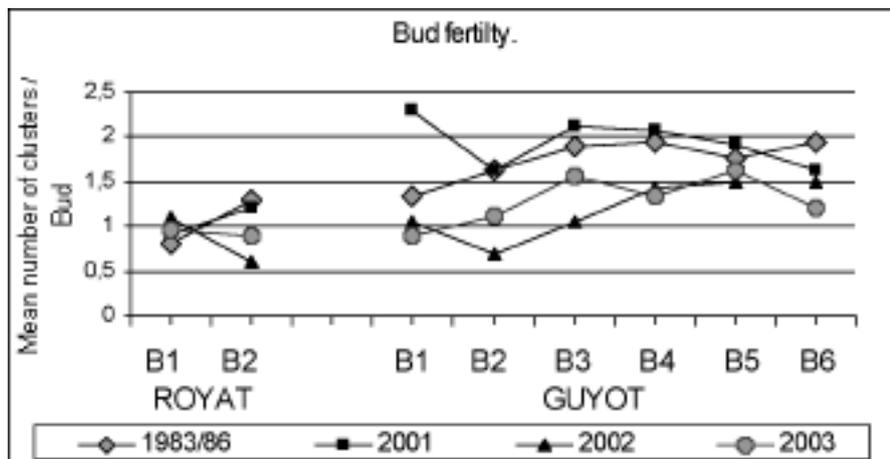


Figure 1 - Variations in bud fertility between the two pruning types considered in different years.
Variations de la fertilité des bourgeons entre les deux types de taille sur différentes années

Table II - Real yield per hectare (kg/hectare) for the different years

	Rendement réel en kilogrammes par hectare sur différentes années			
	1983/86	2001	2002	2003
Royat	18270	22780	5590	N/d
Guyot	27300	27920	6010	N/d

N/d.: Not harvested yet ; pas encore récolté.

the growing season. This situation allows to have an estimation of the harvesting volume, and to know if the volume is superior or inferior to the volumes of the past years. As a matter of fact, this method will be most accurate if in a vineyard the estimation of the bud fertility can be repeated in several years, in order to increase the data basis and to have an estimation of the other components of the yield (LOPEZ y YUSTE pers.com).

The variations on the bud fertility had a strong influence on the yield obtained, and this situation was independent of the year and the pruning system used.

The year 2001 showed an increase in the bud fertility and in the yield, compared to the historical series (1983/86). On the other hand, the year 2002 showed a decrease in bud fertility and yield. In both years the pruning system used had a strong influence over the two parameters under study (figures 2 and 3).

The figure 2 shows the effect of Royat pruning system on the bud fertility and yield for the years 2001 and 2002. For the year 2001, this figure shows how a small increment in the bud fertility, produced an increase in yield of 25 % compared to the historical series.

On the other hand, for the year 2002 the figure 2 shows how a reduction in 30 % of the bud fertility, provoked a yield reduction of about 70 %. The explanation for this behavior is that this method takes into account the number of clusters, and it doesn't take on account the loses that occur in the rest of the compounds of the yield, through the growing season.

The estimation of the bud fertility made in November of the year 2002, allows us to have an idea about the harvesting volume for the year 2003. Taking into account the data shown on the figure 2 we can affirm that the yield for the year 2003, would be higher than those observed for the year 2002, but lower than those observed for the year 2001 and for the historical series (figure 2).

As a matter of fact the yield observed for the year 2003 for this pruning system, was of 13 698 kilograms per hectare. This value is inside the limits of the prediction that has been made.

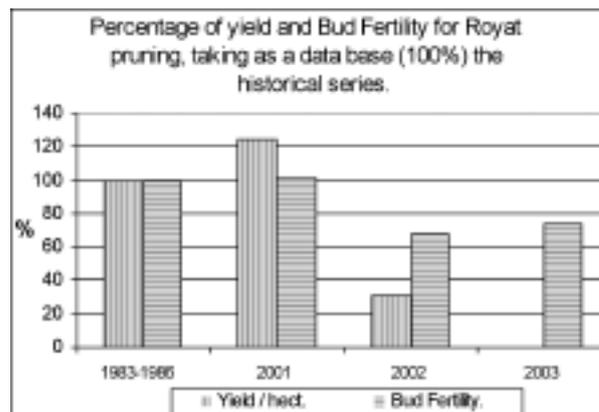


Fig. 2 - Percentage of yield and bud fertility for Royat pruning, taking as a data base (100 %) the historical series.

Pourcentage de rendement et de la fertilité des bourgeons avec la taille Royat par rapport à la série historique.

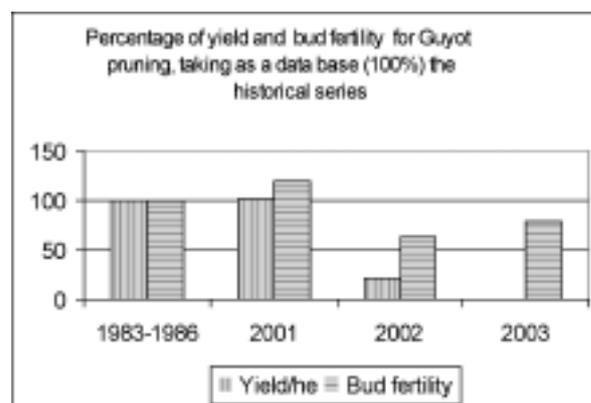


Figure 3 - Percentage of yield and bud fertility for Guyot pruning, taking as a data base (100 %) the historical series.

Pourcentage de rendement et de la fertilité des bourgeons avec la taille Guyot par rapport à la série historique.

The figure 3 presents the situation for the Guyot pruning. As described for the Royat pruning, it is interesting to see the situations that took place in the years 2001 and 2002.

The year 2001 showed that an increase of the bud fertility of 50 % compared to the historical series, but it did not show an increase in the yield.

In the case of the year 2002, a reduction of the fertility of 40 % provoked a reduction of the yield in 80 %.

The data shown on the figure 3, including the estimation of the bud fertility made at November of 2002 allow us to have an estimation of the harvesting volume

for the year 2003. The yield for the year 2003, will be higher than the yield of the year 2002, but it will be less than the yield values of the historical series and the years 2001.

The real yield for the year 2003 considering this pruning system, was of 14 202 kilograms per hectare. This yield value is higher than the yield obtained in the year 2002, and it is inferior to the yield values observed for the historical series and the years 2001, as it was estimated.

CONCLUSIONS

The pruning system used in variety *Vitis vinifera* cv. Tannat, has shown to have a strong influence on the yield. Guyot pruning, showed in all the years higher yields than Royat pruning.

The bud fertility of the basal buds is low, and increases from the bud of rank three and on.

The fertility of the buds of the first two ranges (B1 y B2), present different values of fertility according to the pruning system considered: Royat has lower fertility than Guyot on the basal buds.

The climatic conditions have a strong influence on the bud fertility. This situation can be observed in the figure 1, where the variation between years of the fertility of the same range can be seen.

This method can be used as a valuable tool for an early determination of the global level of harvesting volume. It is an useful tool for the determination of the cultural practices to be held in the vineyard, for example: cluster thinning in the case of the years of high levels of production.

It also important to continue with the studies and to build a multifactorial model, in order to increase and exploit the data basis with the objective to gain accuracy of this forecasting method.

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