EVALUATION OF THE AGRONOMIC PERFORMANCE OF CVS. SYRAH AND TEMPRANILLO WHEN GRAFTED ON A NEW SERIES OF ROOTSTOCKS DEVELOPED IN SPAIN

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Abstract:

Context and purpose of the study - The choice of an adequate rootstock is a key tool to improve the performance of grapevine varieties in different '*terroirs*', as rootstocks confer adaptation to soil characteristics such as salinity, acidity, lime content or drought. Moreover, it is well-known that rootstocks also have a significant influence on the growth and vegetative cycle of the plants and, consequently, on yield and grape quality, and they can be a relevant adaptation tool of viticulture in a changing climate. Therefore, it is essential to have a sufficient supply of rootstock varieties in order that the winegrowers can choose the best suited to the different growing conditions. However, since the beginning of the 20th century, the development of new grapevine rootstocks has been very limited, despite growers' needs have changed dramatically. The objective of this study was to evaluate the agronomic performance of cvs. Syrah and Tempranillo when grafted on eight new rootstocks belonging to the RG-Series, obtained by the Spanish nursery Vitis Navarra.

Material and methods - The evaluation was performed during 4 consecutive seasons in a vineyard located in Miranda de Arga (Navarra, Spain), where Syrah and Tempranillo are grown grafted on 10 different rootstocks (eight new rootstocks and the two parental, 41B and 110R). The vineyard was planted following a completely randomized experimental design, with three replicates of ten vines. During the study period (2015-2018), parameters related to growth, yield, and industrial and phenolic quality were collected in order to evaluate their performance.

Results - The different rootstocks significantly modified growth, yield and quality parameters in both varieties, some showing very promising features for higher yielding vineyards, and some not so productive but interesting for higher quality grape production.

Keywords: grapevine, growth, yield, industrial quality, phenolic quality.

1. Introduction

The use of rootstocks in viticulture is the result of the introduction of phylloxera in the second half of the 19th century (Ollat et al. 2016, Piqueras 2005) and nowadays, more than 80% of the vineyards globally are grafted (Ollat et al. 2016). Moreover, rootstocks not only confer pest resistance but also provide adaptability to soil characteristics such as salinity, acidity, lime content or drought (Australia 2012, Ollat et al. 2016, Pavloušek 2010), and they also have asignificant influence on the growth and vegetative cycle of the plants and, consequently, on yield and grape quality (Main et al. 2002, Reynier 2012). Therefore, it is essential to have a sufficient supply of rootstock varieties in order that the winegrowers can choose the best suited to the different growing conditions.

However, hardly any new rootstock has been developed since the beginning of the 20th century because the process requires a great effort and knowledge, and it is undeniable that the needs of the sector are changing, so it would be of great interest to have new rootstocks better adapted to the new scenario.

Consistent with this premise, the objective of this study was to evaluate the agronomic performance of cvs. Syrah and Tempranillo when grafted on eight new rootstocks belonging to the RG-Series, obtained by the Spanish nursery Vitis Navarra.

2. Material and methods

Plant material and growing conditions

The trial was conducted in an experimental vineyard located in Miranda de Arga (42°27'50.6"N 1°48'10.6"W, 308 MASL), where cvs. Syrah and Tempranillo were grafted on 8 new rootstocks (RG serie: RG2, RG3, RG4, RG6, RG7, RG8, RG9 and RG10) and their parental (110 R and 41 B MGt). The vines were trained to unilateral cordon Royat, pruned to 5 two-shoot spurs per linear meter. Plant spacing was 3 m between rows and 1 m between plants (3,333 vines/ha), and the field was drip irrigated to avoid water deficit. The trial was established in 2012 (cv. Tempranillo) and 2013 (cv. Syrah), following a completely randomized experimental design, with three replicates of ten vines per rootstock. The climate in this area is Continental-Mediterranean, with an average annual rainfall about 350-400 mm. The vineyard is located in a Quaternary sedimentary soil with a sandy loam texture, and 8% of active lime. The evaluation was performed during four consecutive seasons (2015-2018).

Plant measurements

Vegetative growth was quantified in winter by measuring the winter Pruning Weight (PruW) of all the plants of each replicate. Yield (Yld) was determined by weighing all the bunches produced in the 10 vines in each replicate. When harvesting, bunch no. per vine (BunNb) was counted, and mean bunch weight (BunW) was calculated as Yld/BunNb. The harvest date was determined each year regarding to grape composition evolution, all rootstocks for each cultivar being harvested the same day.

Grape composition was determined in a 200-berry sample per replicate, picked the day before harvest. Once all the samples were collected, they were weighed immediately to determine mean berry weight (BW, g) and delivered at low temperature to Excell Iberica (Logroño, Spain) laboratories for analysis. Total Soluble Solid content (TSS, °Brix) was measured using a high precision temperature compensating refractometer, and pH were determined by a digital pHmeter, both following the methodology explained in (CEE) Nº 2676/90. Total acidity (TA, g tartaric acid/L) were determined by titration and malic acid (MalA, g/L) by enzymatic analysis. Total anthocyanin content (Ant, mg/L) was determined following the method proposed by Ribéreau-Gayon and Stonestreet (1965). Tannins reactivity was evaluated using DMACH index (by reaction with p-dimethylamino cinnamaldehyde) proposed by Vivas et al. (1994). The rest of the phenolic maturity parameters (Potential Tannins Index, Tan; Tannins maturity Index, TanM, and Organoleptic Potential, OrgP), were calculated following the standardized protocol developed and patented by Excell in France, and results from mathematical calculations of the abovementioned variables.

Statistical analysis

Simple descriptive statistics were generated in Microsoft Excel as a preliminary analysis of the effect of the rootstock on the agronomic performance of cvs. Syrah and Tempranillo.

3. Results and discussion

Rootstocks clearly affect vegetative growth and yield both for cvs. Syrah and Tempranillo, as shown by important differences in terms of PruW and Yld (Figures 1 and 2). Generally, the new RG-series showed an intermediate or better behaviour than their parental, although the effect of RG2 was significantly worse than the rest, especially in Tempranillo.

In cv. Syrah, RG2 and RG6 were the least vigorous rootstocks, whereas RG2 and RG9 were those in cv. Tempranillo, with values of PruW less than 0.4 kg $vine^{-1}$. RG3, RG4, RG7, RG9 and RG10 showed intermediate behaviour in cv. Syrah, with values of PruW between 0.4 and 0.6 kg $vine^{-1}$, similar to their parental. For their part, RG3, RG4, RG6, RG7 and RG10 showed intermediate behaviour in cv. Tempranillo.

On the other hand, RG8 stood out for its high vigour in the two varieties (0.8 and 0.6 kg $vine^{-1}$ of PruW, consecutively for cvs. Syrah and Tempranillo).

In terms of yield, RG2 was significantly the least productive one, with 1.1 kg $vine^{-1}$ in cv. Syrah and 0.2 kg $vine^{-1}$ in cv. Tempranillo. RG9 had also low productivity in cv. Tempranillo, with less than 1 kg of grape per vine. RG4 and RG8 were the most productive rootstocks in the two varieties, with approximately 2.5 kg of grape per vine.

As growth and yield have normally a direct effect on grape development, differences in terms of industrial and phenolic quality were also founded between rootstocks. Those rootstocks which showed high yield, obtained generally the lowest values of organoleptic potential, tannins and anthocyanins. However, most of the new rootstocks improved the behaviour of their parental in terms of phenolic quality. RG9, despite the fact that it was not very productive, highlighted in both varieties for its high quality grape production. On the other hand, RG8 showed very promising features for higher yielding vineyards.

4. Conclusions

The results demonstrated the great influence that rootstocks have on vine performance, although all the new rootstocks had the same *pedigree*, since they had a significant effect on growth, yield, phenology and quality parameters in both varieties. Some of them showed very promising features for higher yielding vineyards, whereas others were not so productive but they seemed interesting for higher quality grape production.

5. Acknowledgments

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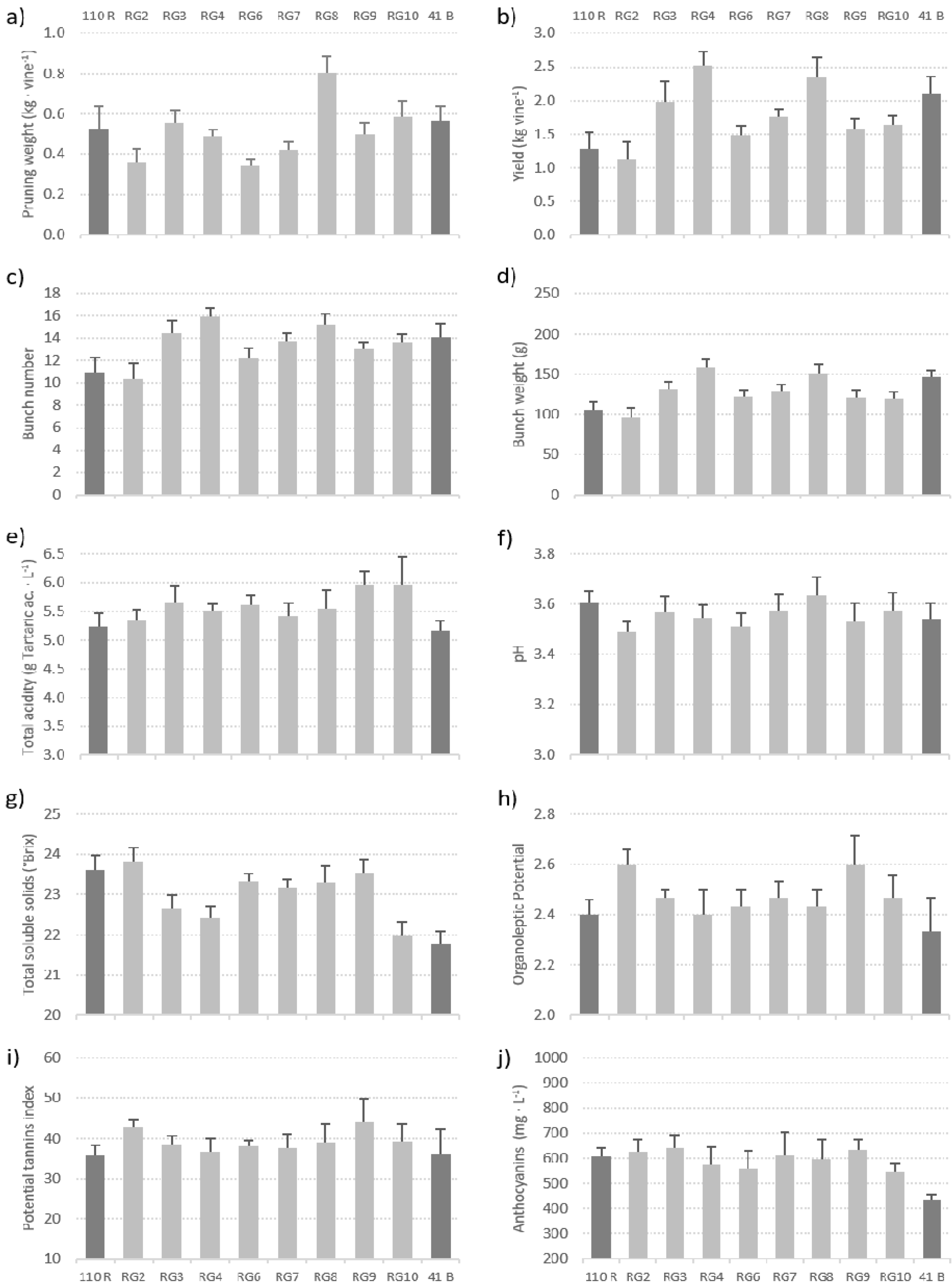

Figure 1: Syrah:a) pruning weight, b) yield, c) bunch number, d) bunch weight, e) total acidity, f) pH, g) total soluble solids, h) organoleptic potential, i) potential tannins index, j) anthocyanins. Bars indicate average standard error per rootstock.

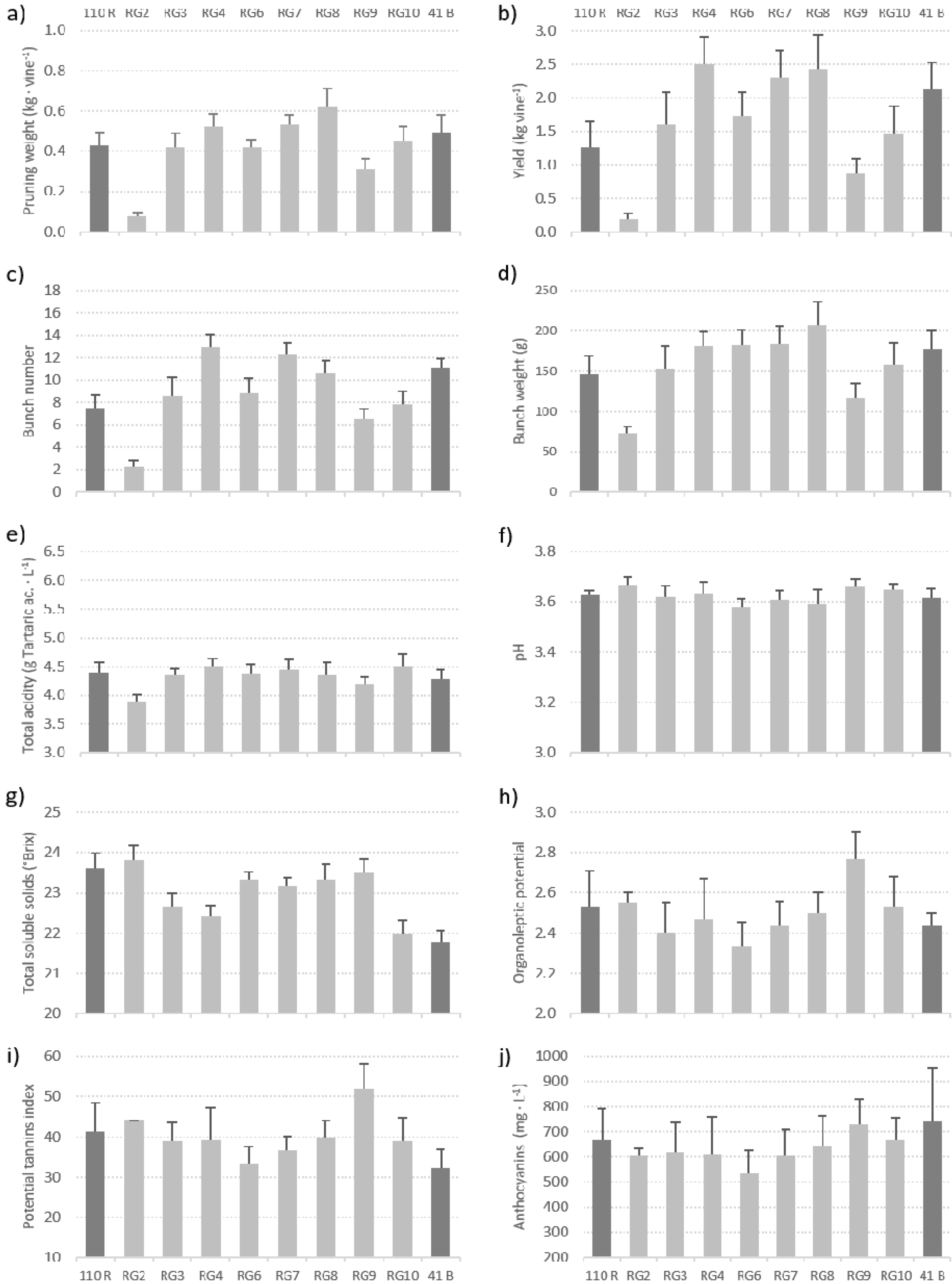

Figure 2: Tempranillo:a) pruning weight, b) yield, c) bunch number, d) bunch weight, e) total acidity, f) pH, g) total soluble solids, h) organoleptic potential, i) potential tannins index, j) anthocyanins. Bars indicate average standard error per rootstock.