International Symposium "Root Research and Applications"
RootRAP, 2–4 September 2009, Boku – Vienna, Austria

Late season root profile development of two contrasting vine rootstocks

Fortea, G[1]; Savé, R[1]; Biel, C[1]; de Herralde, F[1]; Aranda, X[1].

[1]IRTA. Torre Marimon. E-08140 Caldes de Montbui (Barcelona), Spain.
Robert Savé, Tf.+34-934674040ext 1326, Fax +34-8650954, robert.save@irta.cat

ABSTRACT

Two years old vine stocks of *Vitis vinifera* cv. Grenache grafted on rootstocks 41-B and 161-49 were placed in a rhizotron in July 2008. New root formation, growth and lignification at different depths were followed from grape harvest (September) to leaf senescence onset (November), along with soil matric water potential (Ψm) and final biomass of shoots and roots. Both rootstocks showed a large amount of new roots in September, apparently ageing to growing and lignified roots before leaf senescence, but only partially for 41-B (root mortality). Ψm reflected differences in root depth profiles: in 41-B, with most roots in the shallowest levels, water uptake was only evident at 20cm, while 161-49, with roots more evenly distributed, affected both depths similarly. However, no differences were found in total root length, total root biomass or root:shoot ratio. No evidence of growth in cool seasons was found. These results suggest contrasting soil exploration strategies in these and other rootstocks, that could be used as an ecophysiological tool to improve water use efficiency under Mediterranean conditions.

INTRODUCTION

Grapevine is a landscape-forming crop that, due to quality and taste demands from consumers, and also due to different agronomical practices, could be vulnerable to global change. In this context, water could be the key to maintain the productivity at high quality levels. In viticulture, different rootstocks are used to obtain water from soils of different characteristics, some being described as more fitted to dry conditions and conferring higher water use efficiency to the stock in a specific soil (Carbonneau 1985). The objective of this work is to study the growth and soil distribution of different grapevine rootstocks under semicontrolled conditions to explore its use as an ecophysiological tool to improve water use efficiency under Mediterranean conditions.

MATERIALS AND METHODS

Two years old vine stocks of *Vitis vinifera* cv. Grenache grafted on two different rootstocks (41-B and 161-49) were placed in a rhizotron (July 2008) consisting in a box of 60 cm x 50 cm surface and 110 cm height, filled with a sandy soil and with a glass front to non-invasively observe root development. Plants were drip irrigated with 0.7 L/day. Soil matric water potential (Ψm) was followed with tensiometers placed at 20 and 60 cm depth. Images of the roots visible in the glass front were taken in September, before grape harvest, and in November, at leaf senescence onset. Roots were classified in three categories according to colour: new roots (white), growing roots (light colours) and lignified roots (dark) (Comas et al 2000). Depth classes were also established in 10 cm intervals, and total root length of every class and category was measured. Finally, vines were removed from the rhizotron and total biomass of shoots and roots was recorded. All statistical procedures were carried out through ANOVA procedure in SAS in Windows (v. 9.1, SAS Institute Inc., Cary, NC, USA).

RESULTS

Differences in depth distribution between rootstocks, root type and phenological state are evident from Figure 1. Root depth profiles were different for the two rootstocks: 161-49, allegedly less drought resistant presented evenly distributed roots, while 41-B showed most roots in the shallowest levels (20-60cm). Accordingly, in a parallel trial in this same setup with drought resistant rootstock 110-R, most roots were recorded in September in mid to deeper levels (50-100 cm; data not shown). Ψm (Figure 2) reflected root distribution: 41-B water uptake was only evident at 20cm, while 161-49 affected both depths similarly. Again, only 110-R, with deeper roots, had a higher effect on Ψm at 60cm than at 20cm (data not shown).

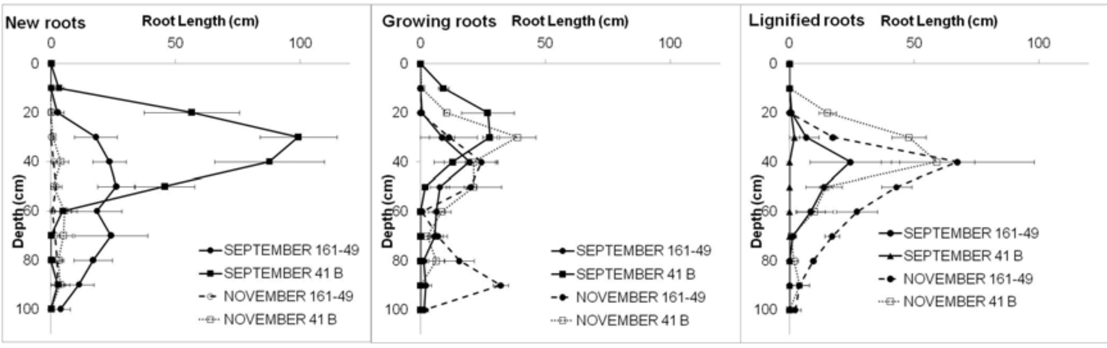
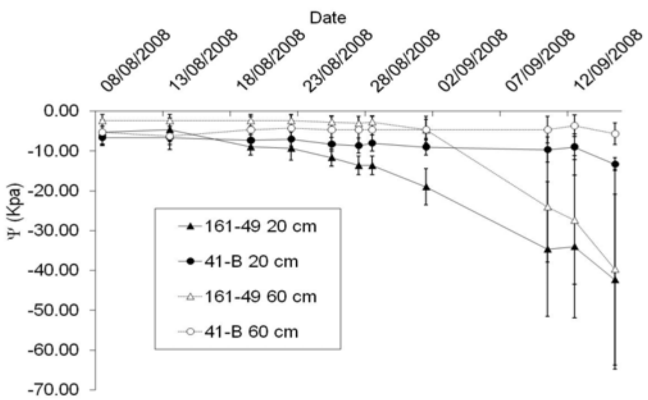


Figure 1. Root length in September and November.

Despite different root profiles, total root length was very similar between rootstocks in both phenological states. All rootstocks showed a large amount of new roots in September, higher in 41-B, that disappeared between grape harvest and leaf senescence, apparently developing to growing and lignified roots. However, a large amount of these roots must have died for 41-B, as shown by a decrease in total root length (Figure 1). This rootstock has been described as presenting a slower root development. In contrast, 161-49 seems to keep most of the observed new roots. These two elements (root profile and new root ageing vs. mortality) might be part of contrasting strategies of soil exploration. However, no effect in biomass production or root to shoot ration was observed in our semicontrolled conditions (Figure 3), with enough water available at every depth.

Although some root growth in cool seasons has been described for some rootstocks, the small number of new roots present in November indicates that root growth is also arriving at a rest, at least for these two rootstocks (Bauerle et al 2008).



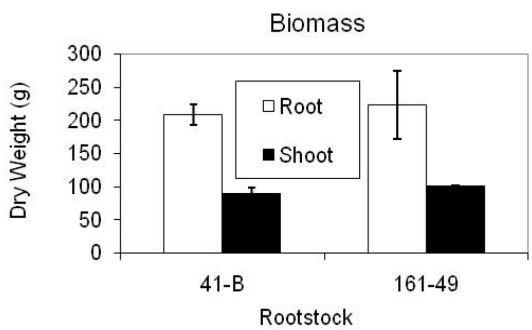


Figure 2. Soil matric water potential.

Figure 3. Root and Shoot final biomass

Bauerle T.L., Smart D.R., Bauerle W., Stockert C.M. & Eissenstat D.M. (2008b) Root foraging in response to heterogeneous soil moisture in two grapevines that differ in potential growth rate. *New Phytologist*, **179**, 857-866.
Comas L.H., Eissenstat D.M. & Lakso A.N. (2000) Assessing root death and root system dynamics in a study of grape canopy pruning. *New Phytologist*, **147**, 171-178.
Carbonneau A. (1985) The early selection of grapevine rootstocks for resistance to drought conditions. *American Journal of Enology and Viticulture*, **36**, 195-198.