

PERFORMANCE OF DATTIER DE BEYROUTH AND ALPHONSE LAVALLÉE GRAPEVINES ON EIGHT ROOTSTOCKS UNDER DRY-LAND CONDITIONS

PERFORMANCE DES VIGNES 'DATTIER DE BEYROUTH' ET 'ALPHONSE LAVALLÉE' NON-IRRIGUÉES SUR HUIT PORTE-GREFFES

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Summary : An experiment was conducted to determine the effects of eight different rootstocks on two non-irrigated table grape cultivars Dattier de Beyrouth and Alphonse Lavallée. Seasonal midday leaf water potential was positively correlated with crop yield. Averaged across both scion and year, the 1103P rootstock had the highest yield while 41B the lowest. Berry size of 'Alphonse Lavallée' on SO4 was greatest both years and for the 'Dattier de Beyrouth' scion on SO4, just one year. The rootstock with the greatest pruning weights (averaged across scion and year) was SO4 while that with the least was R-Lot. Based upon the yield data and characteristics of the fruit, 1103P would be recommended as the rootstock for use in this area under dry-land farming conditions, for the production of these two table grape cultivars.

Résumé : Une étude a été menée sur deux années pour déterminer les effets de huit porte-greffes sur deux cépages de raisin de table Dattier de Beyrouth et Alphonse Lavallée non-irrigués. Le potentiel hydrique des feuilles moyen était positivement corrélé avec la production des souches. L'analyse des résultats moyens sur les deux années montrent que les porte-greffes 1103P et 41B ont enregistré respectivement la production maximum et minimum des scions. Le poids maximum des baies était obtenu avec le porte-greffe SO4, pendant les deux années pour le cépage Alphonse Lavallée, et une seule année pour le cépage Dattier de Beyrouth. Le bois de taille moyen (années et cépages inclus) était maximum pour le porte-greffe SO4, minimum pour R-Lot. En se basant sur la production des souches et les caractéristiques des fruits des deux cépages, le porte-greffe 1103P peut être recommandé pour les vignobles non-irrigués dans la région d'étude.

Key words : grapes, drought, water potential, water-status.

Mots clés : raisin, sécheresse, potentiel hydrique, état hydrique.

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INTRODUCTION

Different studies have reported the existence of drought tolerance among rootstock varieties, presumably due to the ability of roots to extract water highly tied up to the soil particles and to survive in drought conditions by better colonization of the soil (CHAMPAGNOL, 1984). Rootstocks can influence a scion's vigor by increased rates of vegetative growth but this may lead to greater berry shatter resulting in a low level of fruit production (OUGH *et al.*, 1968). Numerous studies have found the rootstock St. George (Rupestris du Lot) to be too vigorous (MULLINS *et al.*, 1992). Cabernet Sauvignon grafted on St. George also had fewer numbers of berries per clusters and fruit set per unit leaf area was about half that of other rootstocks (WINKLER *et al.*, 1974).

The objectives of this study were to determine the effects of different rootstocks on vine water status, yield, and fruit quality of Alphonse Lavallée and Dattier de Beyrouth table grape cultivars, grown under dry-land farming conditions in Morocco.

MATERIALS AND METHODS

Vitis vinifera L. (cultivars Dattier de Beyrouth and Alphonse Lavallée) vines used in this study were grafted onto eight different rootstocks and planted in 1985 with three replicates of three vines each. The vineyard was located near Meknes, one of the major grape production regions in Morocco. The vineyard soil was composed of 74.0 % sand. The vineyard was flat and not irrigated. Vine and row spacings were 1.5 and 3.0 m, respectively. The vines were head trained and pruned to two canes of 6 to 10 buds each. The two wire-trellis used was composed of a cane-wire and a foliage-wire located 0.70 and 1.00 m above

the soil, respectively. The eight rootstocks used in this study were: Richter 99 (99R), Richter 110 (110R), Rupestris du Lot (syn. St. George), Ruggeri 140 (140Ru), SO4 (syn. Selection Oppenheim 4), 41B, 101-14 and Paulsen 1103 (1103P).

Midday leaf water potential (ψ_L) was measured with a pressure chamber (PMS Instrument Co., Corvallis, OR) once monthly (May, June, July and August) in 1995 and 1996, determined on the most recent, fully expanded leaf ($n = 9$; one leaf per vine in each plot) on sun-exposed shoots. At harvest, crop yield and cluster number per vine were recorded and samples of 100 berries per individual plot were randomly collected and analyzed for weight, soluble solids concentration by digital refractometer and titratable acidity. Pruning weight was determined at dormant season. The experimental design was a complete randomized block, data were analyzed using analysis of variance and Duncan's multiple-range test for mean separations.

RESULTS

Annual rainfall at the plot site was 303 mm in 1995 and 827 mm in 1996. Rainfall that occurred during the growing season (budbreak to harvest) amounted to 145 and 279 mm, in 1995 and 1996, respectively.

For Dattier de Beyrouth grapevines, the seasonal midday ψ_L averaged across all rootstocks was -1.4 MPa in 1995 and -1.0 MPa in 1996, the seasonal mean ψ_L of the 41B rootstock was significantly lower than those of SO4 and 1103P both years. In 1995, scions grafted on R-Lot and 1103P had the lowest and highest yield, respectively (table I). The largest and smallest berries were measured on 1103P and R-Lot, respectively. R-Lot had

Table I - The effect of rootstock on yield and fruit characteristics of Dattier de Beyrouth grapevines
Effet du porte-greffe sur la production et les caractéristiques des raisins du cépage Dattier de Beyrouth

1995 data				1996 data			
Rootstock	Yield (kg/vine)	Berry wt (g)	° Brix	Rootstock	Yield (kg/vine)	Berry wt (g)	° Brix
P-1103	3.70 a ^y	6.68 a	16.4 abc	P-1103	6.43 a	5.60 bc	18.3 ^z
41-B	3.10 ab	4.14 bc	14.4 c	140-Ru	5.22 ab	5.82 bc	17.8
140-Ru	2.37 abc	4.93 bc	17.5 abc	99-R	5.21 ab	6.32 ab	16.4
99-R	2.20 bc	4.53 bc	14.9 bc	SO4	4.25 b	6.54 a	18.9
101-14	2.00 bc	4.69 bc	17.8 ab	R-Lot	4.23 b	5.63 bc	17.1
110-R	1.87 bc	3.91 c	17.6 abc	101-14	2.17 c	5.73 bc	17.1
SO4	1.77 bc	5.55 ab	15.7 abc	41-B	1.78 c	5.39 c	16.1
R-Lot	1.33 c	3.56 c	18.7 a	110-R	1.50 c	5.48 c	17.0

^yMeans followed by a different letter within a column are significantly different at the 5 % level using Duncan's multiple range test.

^zMeans were not significantly different in this column.

Table II - The effect of rootstock on yield and fruit characteristics of Alphonse Lavallée grapevines.
Effet du porte-greffe sur la production et les caractéristiques des raisins du cépage Alphonse Lavallée.

1995 data				1996 data			
Rootstock	Yield (kg/vine)	Berry wt (g)	° Brix	Rootstock	Yield (kg/vine)	Berry wt (g)	° Brix
P-1103	2.93 a ^y	4.14 bcd	15.6 ab	101-14	4.34 a	5.43 ab	16.3 bc
110-R	2.93 a	5.37 ab	15.9 a	P-1103	4.00 a	5.86 ab	14.3 c
R-Lot	2.46 ab	3.58 cd	15.6 ab	SO4	3.74 a	5.90 a	15.2 bc
SO4	2.10 b	6.09 a	14.2 b	110-R	3.00 ab	4.96 b	15.4 bc
140-Ru	1.87 bc	3.02 d	15.7 ab	41-B	2.20 ab	5.41 ab	15.1 bc
101-14	1.87 bc	4.14 bcd	17.0 a	140-Ru	2.02 ab	5.57 ab	17.0 ab
99-R	1.37 c	4.41 bcd	16.3 a	R-Lot	1.00 b	5.04 ab	19.1 a
41-B	1.23 c	5.02 abc	15.6 ab	99-R	0.90 b	5.17 ab	15.0 bc

^yMeans followed by a different letter within a column are significantly different at the 5 % level using Duncan's multiple range test.

the highest soluble solids concentration, while 41B had the lowest. In 1996, scions grafted on 1103P had the highest yields while those on 110R and 41B had the lowest. Also, there was a significant difference among rootstocks with regard to berry weight, SO4 had the largest while 110R and 41B the smallest. There was no significant difference in fruit soluble solids concentration. For both years, fruit titratable acidity and scion pruning weight were lower on R-Lot (not reported).

For Alphonse Lavallée grapevines, the seasonal mean ψ_L averaged -1.38 MPa and -1.12 MPa in 1995 and 1996, respectively. In 1995, R-Lot had the most negative seasonal mean ψ_L and it was significantly different from 1103P. In 1995, 110R and 1103P rootstocks had the highest yields while 41B and 99R had the lowest (table II). The largest berries were on the 110R rootstock while the smallest berries were on the R-Lot rootstock. At fruit harvest, the lowest soluble solids concentration was measured in the fruit on SO4 while the greatest was measured in fruit on 101-14, 110R and 99R. Fruit titratable acidity and scion pruning weight were lower on R-Lot (not reported). In 1996, the highest yields were measured on the rootstocks 101-14, SO4 and 1103P, while the lowest occurred on R-Lot and 99R. The largest berries were on SO4 while the smallest were on 110R. Soluble solids concentration was highest (+ 4.8 ° Brix) in the fruit on R-Lot but lowest in the fruit on 1103P.

DISCUSSION

There was a seasonal decline in ψ_L for both cultivars reflecting in part the fact that these vines were not irrigated. The rootstocks with the highest seasonal midday ψ_L in 1995 for both cultivars were 1103P and SO4 (averaging -1.3 MPa) while 41B and 101-14 had the lowest

values (averaging -1.5 MPa). It would appear that in a dry year rootstock plays a major role in determining a scion's water status, whereas in a year with more available water, other conditions or overall vegetative growth may have more of an influence.

Yield from 1996 was greater than that recorded in 1995 for both cultivars. This can be explained in part by better fruit set (data not given) and larger berries in 1996 compared to 1995. Averaged across all rootstocks in 1995, there was a significant correlation ($r = 0.54$) between seasonal mean ψ_L and yield per vine for Alphonse Lavallée ; however, this was not true for Dattier de Beyrouth scion. Yield in 1996 showed a significant correlation between ψ_L and yield per vine for both Dattier de Beyrouth ($r = 0.73$) and Alphonse Lavallée ($r = 0.56$). Dattier de Beyrouth scions grafted on 1103P, 140Ru and 99R had relatively higher yields (more than 5 kg/vine) and relatively less negative ψ_L than on the other rootstocks. The rootstocks with the most negative ψ_L , R-Lot and 41B, however, resulted in moderate and low yields, respectively.

Averaged across all rootstocks, the correlation between ψ_L and berry weight was positive in 1995 (0.40 for Dattier de Beyrouth and 0.15 for Alphonse Lavallée), and significant in 1996 (0.69 for Dattier de Beyrouth and 0.57 for Alphonse Lavallée). Such a relationship has been found for Thompson Seedless (WILLIAMS, 2000) and Cabernet Sauvignon (L.E. Williams, unpublished data) grapevines irrigated with various amounts of water, relative to full crop evapotranspiration.

The 1103P rootstock had high soluble solids concentrations for both cultivars in 1995 but the rootstock with the highest berry soluble solids concentration, R-Lot, also had the lowest yield for the Dattier de Beyrouth scion.

This was probably due to a concentration effect of the vines having a smaller crop load using this rootstock. This was also observed for Alphonse Lavallée scions on 101-14, 110R and 99R rootstocks. Data of 1996 also revealed that Dattier de Beyrouth fruit on 1103P and SO4 had high sugar content, however 1103P had the highest crop per vine. A larger crop load is usually associated with lower sugar concentration in the fruit, however, over irrigation can also decrease soluble solids (WILLIAMS, 2000).

Based upon yield and berry characteristics, the rootstock 1103P performed the best. It ranked highest in yield during the dry year for both cultivars and was either first or second in yield for the wet year, 1996. Averaged across both years and cultivars, yield of 1103P was 4.27 kg vine⁻¹. The rootstocks with the next highest yields, using the same criteria, were SO4 (2.97 kg vine⁻¹) and 140Ru (2.87 kg vine⁻¹). The rootstocks with the lowest yields were R-Lot (2.26 kg vine⁻¹) and 41B (2.08 kg vine⁻¹).

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