Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.8077

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (1):** 1198-1203 (2018)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Influence of Different Rootstocks on Growth and Yield of Commercial Grape Varieties

B. Nithya Menora[*], Veena Joshi[1], N. Pramod Kumar[2] and Y. Vijayanthi Kalyan[3]

[1]College of Horticulture, SKLTS Horticultural University, Hyderabad-500030

[2]Herbal garden, Rajendra nagar, Hyderabad- 500030

[3]Horticulture Officer, Office of DHSO, Vikarabad- 501101

College of Horticulture, SKLTS Horticultural University, Hyderabad-500030

*Corresponding Author E-mail: nithya.menora1990@gmail.com

Received: 11.08.2017 | Revised: 19.09.2017 | Accepted: 25.09.2017

ABSTRACT

An experiment was conducted during 2013-14 in the experimental vineyard of Grape Research Station, Rajendranagar, Hyderabad to study the effect of different rootstocks (1103 P, SO_4, Dog ridge and own root) on growth and yield of commercial Grape varieties (Thompson Seedless, Flame Seedless and Kishmish Chorni). Rootstock plays a vital role in manipulation of the vine growth and productivity in grape. It has potential for combating the soil problems and also has ability to tolerate abiotic stresses viz., drought, salinity etc. Besides these, rootstocks also ensure profitable production by enhancing uniform growth and yield. Irrespective of the varieties, the Dogridge rootstock found to be vigorous in terms of pruning weight (3.29 kg/vine), cane diameter (8.07 mm), number of bunches per vine (34.26) and yield (13.06 kg/vine) whereas earliness in terms of bud break was reported with own root (9.06 days) compared to the rootstocks.

Key words: *Rootstocks, Pruning weight, Yield, Thompson Seedless, Flame Seedless, Kishmish Chorni.*

INTRODUCTION

In the traditional viticulture in India, commercial varieties of grapes are grown on their own roots[13]. In India a decline in the productivity of table grapes in the major grape growing states of Maharashtra, Karnataka and Telangana led the way to the utilization of rootstocks in grape, hence the need for rootstock was felt during the past couple of decades due to the increasing problems like drought, soil salinity and poor fruitfulness. Apart from combating the soil problems, rootstocks also ensure profitable production by enhancing uniform growth and yield. Besides these, rootstocks provide a large number of choices to grape growers to increase fruit quality, ensure uniform and quick bud burst, for increased fruitfulness, to maintain vine vigour. Keeping in view of above, an experiment was proposed to study the effect of rootstocks on growth and yield of commercial grape varieties.

Cite this article: Menora, B.N., Joshi V., Kumar, N.P., Kalyan, Y.V., Influence of Different Rootstocks on Growth and Yield of Commercial Grape Varieties, *Int. J. Pure App. Biosci.* **6(1):** 1198-1203 (2018). doi: http://dx.doi.org/10.18782/2320-7051.8077

MATERIAL AND METHODS

The study was conducted during 2013-14 in the experimental vineyard of Grape Research Station, Rajendranagar, Hyderabad which falls in semi arid climatic zone. The Research Station is located at 77º 85' E longitude and 18º 45' N latitude and at an altitude of 542.6 m above mean sea level, with the average annual rainfall 0f 800mm.

All the vines were pruned twice in an annual growth cycle, which is a common practice in tropical viticulture. The first pruning is done immediately after fruit harvest during the summer months to develop fruitful canes, popularly called "back pruning", and another pruning is done at about five to six months after back pruning on the fruitful canes to encourage cluster development. This is popularly known as "forward pruning". Within 24 to 48 hours after forward pruning, two to three apical buds on the pruned canes were swabbed with a bud-breaking chemical, hydrogen cyanamide (at 1.5% a.i.), commercially known as "Dormex", to facilitate quick and uniform bud burst.

The experiment was conducted on a six-year-old orchard, planted at spacing of 10 x 6 ft and trained on "Y trellis system". There were twelve treatments and replicated four times, in a Factorial Randomized Block Design. One of the factor includes three different varieties of grape (Thompson Seedless, Flame Seedless, Kishmish Chorni) and the other factor includes three different rootstocks (1103 P, SO_4, Dog ridge) and own rooted vine as control.

The characteristics of the above rootstocks are:

1103P	• It is a cross between Berlandieri Resseguier No. 2 and Rupestris du Lot (St. George). • It is a vigorous rootstock and adoptable to the clay-lime soils • Resistant to drought and excess soil moisture in spring. Moderate tolerant to salinity. It is recommended for very dry conditions.
SO_4	• It is an abbreviation of Selection Oppenheim No. 4. • The rootstock shows moderate to high vigour It is slightly drought tolerant rootstock. Suited to humid, clay soils, it has a good resistance to nematodes.
Dogridge	• It is a natural hybrid of Rupestris-candicans. • It is tolerant to salinity and well suited for less fertile soil. It is moderately resistant to phylloxera and lime

The influence of rootstock on growth parameters includes pruning weight, days taken for bud burst, no. of canes per vine, no. of fruitful canes per vine, cane diameter and yield parameters *viz*., number of bunches per vine, and fruit yield per vine was recorded during the study.

Pruning weight (kg/vine)

Pruning weight was recorded as a measure of vine vigour after harvest during the course of the study and expressed in kg/vine.

Days taken for bud break

Days taken for bud break were measured after forward pruning. The first sprouted bud with fully expanded leaf was taken as an indicator to measure the days taken to bud break[13].

Cane diameter (mm)

The cane diameter was measured between the fifth and sixth node at shoot maturity with vernier calipers on ten canes per vine and expressed in mm.

Number of bunches per vine

The number of bunches was counted in each treatment before harvest and harvesting was done manually.

Yield (kg/vine)

Total number of bunches of each vine were counted and multiplied by average bunch weight. The resultant was considered as average yield/vine and expressed as kg/vine.

STATISTICAL ANALYSIS

The data was analysed according to procedure of analysis for Factorial Randomized Block Design given by Panse and Sukhatme[12]. The significant variation among the treatments was observed by applying F-test and critical difference (CD) was worked out at 5% level of

probability to judge the differences between means of two levels of a factor.

RESULTS AND DISCUSSION

Pruning weight (kg/vine)

Results pertaining to the pruning weight was significantly influenced by the varieties and rootstocks and the data was presented in the table 1.

With respect to rootstocks, varieties grafted Dogridge recorded higher pruning weight (2.25 kg/vine) whereas own rooted vines as control recorded the lowest pruning weight (1.30 kg/vine). Interaction effect was found to be significant. Thompson Seedless on Dogridge rootstock recorded highest pruning weight (3.29 kg/vine) while Kishmish Chorni on 1103P (1.36 kg/vine) and SO 4 (1.36 kg/vine) recorded least pruning weight.

The vigour of vine is expressed in terms of pruning weight and this character is an important growth attribute for distinguishing different grape varieties as vigorous and non-vigorous based on growth rate[2,4,13,14,15]. The amount of pruning weight depends upon the vigour of the vine, highly vigorous vines produce more pruning weight than less and medium vigorous varieties. The difference in the pruning weight among the varieties due to rooststocks may be due to the difference in the vigour of vine resulting from assimilation of carbohydrates due to more number of canes, number of leaves produced and other growth parameters results in more dry matter production.

Table 1: Effect of different rootstocks on pruning weight (Kg/vine) in commercial varieties of grape

Table 1	Pruning weight (Kg/vine)				
	ROOTSTOCKS				
VARIETIES	1103P	SO4	Dogridge	Ownroot	Mean of Varieties
Thompson Seedless	2.53	2.73	3.29	1.75	2.57
Flame Seedless	1.68	1.81	1.82	1.24	1.63
Kishmish Chorni	1.36	1.36	1.65	0.93	1.32
Mean of Rootstocks	1.85	1.96	2.25	1.30	
CD of Rootstocks at 5%	0.30			SEm±	0.10
CD of Varieties at 5%	0.26				0.09
Rootstock x variety at 5%	0.52				0.18

Days taken for bud break

Among the rootstocks, own rooted vines *i.e.* control took less days for bud break (9.06 days) and varieties grafted on Dogridge took more days for bud break (13.29 days) with respect to the interaction, Flame Seedless on own root (8.12 days) was early and Thompson Seedless on SO 4 (11.07 days) was late to bud break. (Table 2)

Bud break is a varietal character as it marks the beginning of seasonal growth. The early and increased percentage of bud burst on own roots might be attributed to the increased activity of peroxidase activity (POD) and fewer growth inhibitors in their buds. The least POD activity in vines on Dogridge rootstock might have resulted in late sprouting of buds as reported by Jogaiah *et al*[7].

Table 2: Effect of different rootstocks on days taken for bud break in commercial varieties of grape.

Table 2	Days taken for bud break				
	ROOTSTOCKS				
VARIETIES	1103P	SO4	Dogridge	Ownroot	Mean of Varieties
Thompson Seedless	9.61	11.07	13.29	9.57	10.13
Flame Seedless	12.88	13.55	13.21	8.12	12.70
Kishmish Chorni	12.25	13.42	13.37	9.13	12.04
Mean of Rootstocks	11.58	12.18	13.29	9.06	
CD of Rootstocks at 5%	1.74			SEm±	0.61
CD of Varieties at 5%	1.51				0.52
Rootstock x variety at 5%	3.02				1.05

Cane diameter (mm)

Among the rootstocks, varieties grafted on Dogridge rootstock registered maximum cane diameter (7.71 mm). Among the varieties, Thompson Seedless (7.50 mm) recorded the maximum cane diameter. The interaction was found to be significant and maximum cane diameter was recorded for Thompson Seedless on Dogridge rootstock (8.07 mm. (Table 3)

Besides pruning weight, the vine vigour can also be judged by the cane diameter. The production of canes depends upon vigour of the vine and their dimensions, which in turn depends upon the extent of stored food material in the vine[4].

In the present investigation, cane diameter is having a wide range, whose results are conformity with the findings of Somkumar *et al*.[16], Reddy *et al*.[11] and Havinal *et al*.[5]. This variation may be due to vine vigour as well as age of the vine.

Table 3: Effect of different rootstocks on cane diameter (mm) in commercial varieties of grape

Table 3	Cane diameter (mm)				
	ROOTSTOCKS				
VARIETIES	1103P	SO4	Dogridge	Ownroot	Mean of Varieties
Thompson Seedless	7.91	6.93	8.07	7.09	7.50
Flame Seedless	7.25	7.07	7.37	7.16	7.21
Kishmish Chorni	7.60	6.19	7.71	6.50	7.00
Mean of Rootstocks	7.58	6.73	7.71	6.91	
CD of Rootstocks at 5%	0.40			SEm±	0.13
CD of Varieties at 5%	0.34				0.10
Rootstock x variety at 5%	0.69				0.23

Number of bunches per vine

Data pertaining number of bunches per vine are presented in the table 4. Among the rootstocks, there was a significant influence on number of bunches per vine. The highest number of bunches per vine was recorded with varieties raised on Dogridge (34.26) and lowest was recorded on SO4 (25.28). Interaction effect between rootstocks and varieties was found to be significant. Kishmish Chorni on Dogridge recorded highest number of bunches per vine which was on par (40.52) with Thompson Seedless on Dogridge (37.52). Number of bunches per vine differs significantly with the variety nutrition of the vine and probable site of growing. The productivity of bunches and bunch weight appears to be a genetic phenomenon, but the climate and soil nutrient status also contribute to certain extent. This difference in the number of bunches per vine may be attributed to varietal character due to more number of canes or immaturity of canes in different varieties.

Even though there are more number of fruitful canes on own root, due to prevailing climatic conditions, Dogridge rootstock performed well. More number of bunches per vine was recorded in varieties raised on rootstocks. The reason for higher number of bunches on Dogridge could be due to more Phosphorous content, high pruning weight, which shows that highly vigorous vines produced more number of bunches. Similar line of work was registered by Kadu[9] and Havinal[6].

Table 4: Effect of different rootstocks on number of bunches per vine in commercial varieties of grape

Table 4	Number of bunches per vine				
	ROOTSTOCKS				
VARIETIES	1103P	SO4	Dogridge	Ownroot	Mean of Varieties
Thompson Seedless	26.82	28.02	34.52	33.82	31.54
Flame Seedless	17.40	22.02	24.73	30.07	23.55
Kishmish Chorni	32.23	25.82	40.52	36.82	33.85
Mean of Rootstocks	25.48	25.28	34.26	33.56	
CD of Rootstocks at 5%	3.26			SEm±	1.13
CD of Varieties at 5%	2.82				0.98
Rootstock x variety at 5%	5.64				1.96

Yield per vine (kg/vine)

It is clear from the data in the table 5, that the rootstocks have significantly influenced the yield of berries per vine. Irrespective of varieties used, the rootstocks have exhibited significant variation in yield. Among the rootstocks, Dogridge rootstock produced highest yield of 13.06 kg/vine and least yields were recorded in case of SO 4 rootstocks (7.89 kg/ vine).

The interaction between varieties and rootstocks was found to be statistically significant indicating the influence of rootstocks on different varieties. On the basis of average yield, it is evident that all the varieties grafted on Dogridge produced higher yields than the other rootstocks. This could be due to its more vigour in the terms of more pruning weight, climatic conditions and finally higher yield per vine.

It has been suggested that excessive vegetative growth can lead to poor setting of the fruit[10] and decreased fruitfulness[3] through competition for assimilates or excessive shading[1]. Similarly, Satisha *et al.*[13] reported that the high vigour rootstocks such as Dogridge and St. George must have influenced the scions to accumulate dry matter in the vegetative portions like the shoot, trunk and canes, while rootstocks such as 110 R, 1103 P and 99 R must have encouraged accumulation in the clusters. Similar concept might be explained in the present experiment as scions on rootstocks showed more vegetative vigour when compared to own roots consequently influencing yields.

Table 5: Effect of different rootstocks on yield (Kg/vine) in commercial varieties of grape

Table 5	Yield (Kg/vine)				
	ROOTSTOCKS				
VARIETIES	1103P	SO4	Dogridge	Ownroot	Mean of Varieties
Thompson Seedless	10.35	8.31	12.80	10.76	10.55
Flame Seedless	8.21	5.13	12.41	7.94	8.42
Kishmish Chorni	12.11	10.23	13.98	10.80	11.76
Mean of Rootstocks	10.22	7.89	13.06	9.83	
CD of Rootstocks at 5%	1.38			SEm±	0.48
CD of Varieties at 5%	1.20				0.41
Rootstock x variety at 5%	2.40				0.83

CONCLUSION

Rootstock is considered as an important tool to manipulate shoot vigour and to bring equilibrium between growth and yield. Dogridge performed well with respect to pruning weight and cane diameter and the interaction was best with Thompson Seedless on Dogridge rootstock with respect to pruning weight, whereas earliness was seen in Flame Seedless on own root. With respect to yield parameters, the performance of varieties raised on Dogridge rootstock was promising.

Acknowledgement

The authors sincerely acknowledge the financial support provided by Dr. Y. S. R. Horticultural University for carrying out the research work.

REFERENCES

1. Amirdzhanov, A.G., The optimal relation between leaf area and grape yield relative to its carbohydrate balance. *Fiziol Rast.* **12:** 13-21 (1965)
2. Benz, M.J, Anderson, M.M, Williams, M.A, Barnhisel, K. and Wolpert, J.A., Viticultural performance of five Merlot clones in Oakville, Napa Valley. *American Journal of Enology and Viticulture.* **57(2):** 23-237 (2006).
3. Carstens, W.J, Burger, J.D. and Kriel, G.L.R. Kultivarbeleid, cultivar eienskappeen plant verbetering. In: Burger, J.D. & Deist, J. (eds). Wingerdbouin Suid-Afrika. Viticultural and Oenological Research Institute, Stellenbosch. Pp: 67 – 119 (1981).

4. Fawzi, F, Bondak, A.Z. and Ghobrial, G.F., Effect of cane length on bud behavior and wood ripening of Thompson seedless grape variety. *Annals Agril.sci.* **29(1):** 465-474 (1984).
5. Havinal, M.N, Tambe, T.N. and Patil, S.P., Comparative studies on vine vigour and fruit fulness of grape wine varieties. *The Asian Jr.Hort*. **3(1):** 180-182 (2008).
6. Havinal, M.N., Screening of wine grape varieties for growth, yield and fruit quality parameters. *Msc. Thesis*, Dept.of Hort, Mahatma Phule krishi vidyapeeth, Rahuri, Maharashtra. (2007).
7. Jogaiah, S, Oulkar, D.P, Banerjee, K, Sharma, J, Patil, A.G, Maske, S.R. and Somkuwar, R.G., Biochemically Induced Variations during Some Phenological Stages in Thompson Seedless Grapevines Grafted on Different Rootstocks. *South African Journal of Enology and Viticulture.* **34(1):** 36-45 (2013).
8. Kadu, S.Y., Tambe, T.B. and Patil, S.P., Studies on leaf morphology and vine vigour of various grape wine varieties. *The Asian Jr.Hort*. **2(1):** 131-134 (2007).
9. Kadu, S.Y., Evaluation of various grape varieties for wine making. *M. Sc. Thesis.* Dept.of Hort, Mahatma Phule krishi vidyapeeth, Rahuri, Maharashtra. (2002)
10. Morton, L.T., The myth of the universal rootstock. *Wines & Vines*. **60:** 24-26 (1979).
11. Reddy, B.M.C, Prakash, G.S. and Chadha, K.L., Effect of rootstocks on growth, yield and quality of Anab-e-Shahi grape. Proceedings of the International symposium on Recent Advances in Viticulture and Oneology, held from 14-17 February, 1992 at Hyderabad, India. 188-193. (1992).
12. Panse, V.G. and Sukhatme P.V., Statistical methods for agricultural workers 2nd Edition ICAR New Delhi (1985).
13. Satisha, J, Somkuwar, R.G, Sharma, J, Upadhyay, A.K. and Adsule, P.G., Influence of rootstocks on growth, yield and fruit composition of Thompson Seedless grapes grown in the Pune region of India. *South African Journal of Enology and Viticulture.* **31(1):** 1-8 (2010).
14. Satisha, J. and Shikhamany, S.D., Annual report, 1998-99. National Research Centre for Grapes, Pune, pp.8 (1999).
15. Shikhamany, S.D., Effect of time and different doses of N and K on growth and yield of Thompson Seedless (Vitis venifera L.). *Ph.D. Thesis* submitted to UAS, Banglore (1983).
16. Somkuwar, R.G, Satisha, J. and Ramteke, S.D., Effect of different rootstocks on fruitfulness in Thompson Seedless (*Vitis vinifera* L.) grapes. *Asian journal of plant sciences*. **5(1):** 150-152 (2006).