



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(8): 1534-1541
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www.thepharmajournal.com
Received: 08-05-2022
Accepted: 12-06-2022

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Assessing the growth attributes of wine varieties of grapes under Southern Telangana conditions

Veena Joshi

Abstract

Thirteen wine grape varieties of which eight coloured and five white were evaluated for growth parameters for Southern Telangana Zone at Grape Research Station, Hyderabad. The varieties are Zinfandel, Cabernet Sauvignon, Shiraz, Ruby Red, Pusa Navrang, Bangalore Blue, Athens and Gulabi are the red varieties whereas, Symphony, Chenin Blanc, Sauvignon Blanc, Thompson Seedless and Italia are the white varieties. Observations recorded on growth parameters revealed that based on the pruning weight, varieties were classified as vigorous (Athens, Shiraz, Ruby Red); moderately vigorous (Italia, Bangalore Blue, Gulabi, Pusa Navrang, Sauvignon Blanc, Symphony and Chenin Blanc); less vigorous (Zinfandel, Cabernet Sauvignon and Thompson Seedless). On the basis of bud break requirement, varieties were grouped as early (Pusa Navrang, Bangalore Blue, Chenin Blanc and Gulabi), mid-season (Sauvignon Blanc, Symphony, Shiraz, Zinfandel, Italia and Cabernet Sauvignon) and late season varieties (Ruby Red, Thompson Seedless and Athens). These results signify the scope of high potential of growing wine varieties under Southern Zone of Telangana.

Keywords: Wine grape varieties, growth, yield

Introduction

The domesticated grape (*Vitis vinifera* L.) is one of the oldest cultivated plants reported to be originated in middle east. The genus *Vitis* comprises of three natural groups based on geographical locations viz., North American, Eurasian and Asiatic. American and Asiatic group have 25-30 species whereas Eurasian has only one species i.e. *Vinifera* which has contributed for advancement of grape cultivation throughout the world. Grape cultivation in India has been commercially taken up under a wide range of soil and climatic conditions. Major grape-growing states are Maharashtra, Karnataka, Telangana, Andhra Pradesh, Tamil Nadu and the north-western region covering Punjab, Haryana, western Uttar Pradesh, Rajasthan and Madhya Pradesh.

The commercial variety of grapes cultivated in Telangana State is Thompson Seedless and its clones. There is hardly any cultivation of juice and wine grapes in Telangana region. There is a need to diversify the uses of grapes in this region. The wine sector is currently demonstrating positive and dynamic growth mainly due to a change in lifestyle, health consciousness and awareness about wine as a healthy drink rather than an alcoholic beverage. Although India is not traditionally a wine drinking country, but the Indian wine industry has been steadily growing over the last decade. Wine is gradually becoming a part of urban Indian life style. This shows the need for development of wine industry in Telangana, for domestic as well as for export market. As a preliminary step there is a need to find the suitability of growing grape wine varieties for wine making, keeping this in view, an experiment was proposed to evaluate growth parameters of wine varieties of grape with an objective to find the suitability of growing wine varieties under Southern Telangana Zone.

Materials and Methods

An experiment was conducted to study the growth performance of wine varieties of grape at Grape Research Station, Rajendranagar, Hyderabad. Thirteen grape varieties (8 coloured and 5 white) grown at Grape Research Station were evaluated for the growth parameters for assessing their suitability for wine production. Among the varieties selected for the study, ten were wine grape varieties introduced from traditional grape growing countries and the remaining three were the native grape varieties viz., Bangalore Blue, Pusa Navrang and Thompson Seedless. Observations on the growth parameters viz., pruning weight, days taken for bud break, number of canes, cane diameter, shoot length, number of leaves, leaf area were

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recorded during the two cropping seasons, First Year (2006-07) and second year (2007-08) and data were analyzed statistically.

Results and Discussions

1. Pruning weight (kg/vine)

The results pertaining to the pruning weight of vine of both the seasons (Summer and Winter) in different varieties of grape for both the years (2006-07 and 2007-08) were presented in the Table-1. It is clear from the data that seasons and years have shown significant influence on the pruning weight in all the cultivars. Similarly, the cultivars showed significant differences among themselves in respect to pruning weight in both the seasons and years.

1a. Summer pruning weight (kg/vine)

Significant variation was observed with respect to the summer pruning weight among the varieties and years while interaction effect was found to be non-significant.

The pooled data signifies that among the varieties evaluated, Athens has recorded highest pruning weight (5.23 kg/vine) closely followed by Cv. Shiraz (4.94 kg/vine) which were in the same order but superior to other varieties. Next in line was Ruby Red (4.26 kg/vine) which differed significantly from the above two cultivars and was at par with Italia (3.73 kg/vine). Lowest pruning weight was recorded by Cv. Zinfandel (1.03 kg/vine), while others recorded intermediate weight ranging from 1.78 to 3.41 kg/vine.

Between the two years, irrespective of the cultivars, the mean summer pruning weight was higher (3.47 kg/vine) in the year 2007-08, than 2006-07 (2.43 kg/vine). When the individual years are considered, during the first year of study (2006-07), highest pruning weight was recorded by the variety Athens (5.06 kg/vine) followed by Shiraz (4.56 kg/vine) while least weight was observed with Zinfandel (0.73 kg/vine). Similar trend was noticed during the second year of study.

The interaction between years and cultivars was found to be non-significant. However, cultivar Athens recorded highest summer pruning weight (5.06 and 5.40 kg/vine), whereas Zinfandel (0.73 and 1.33 kg/vine) produced least pruning weight in both the years of study.

1b. Winter pruning weight (kg/vine)

It is evident from the Table-1 that significant variation existed with respect to winter pruning weight among the varieties and between the years.

The perusal of pooled data indicates that cultivar Shiraz (2.76 kg/vine) recorded highest pruning weight and was superior to other varieties. This was followed by cultivar Athens (2.21 kg/vine), which differed significantly from Shiraz and was superior to others. Winter pruning weight was least in case of Zinfandel (0.46 kg/vine) followed by Sauvignon Blanc (0.64 kg/vine) and Chenin Blanc (0.78 kg/vine), and were in the same order. Rest of the cultivars recorded intermediate values for pruning weight between Shiraz and Chenin Blanc.

Significant difference between the years in respect to winter pruning weight was also observed. However, when the means of the years were considered, winter pruning weight was higher (1.62 kg/vine) in the year 2007-08 than that of 2006-07 (1.00 kg/vine).

During the first year, cv. Shiraz recorded highest pruning weight (2.13 kg/vine) closely followed by Athens (2.03 kg/vine) while least winter pruning weight (0.23 kg/vine) was observed in Sauvignon Blanc closely followed by Zinfandel

(0.26 kg/vine). In the year 2007-08, similar to that of first year, Shiraz has registered highest winter pruning weight (3.40 kg/vine) again followed by Athens (2.40 kg/vine) while Zinfandel recorded least pruning weight (0.66 kg/vine) followed by Chenin Blanc (0.83 kg/vine). Thus, there is consistency in case of certain cultivars in both season and years of studies. Interaction between varieties and years was found to be non-significant.

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 (Shikhamany, 1983; Fawzi *et al.*, 1984; Satisha and Shikhamany, 1999; Benz *et al.*, 2006) [18, 4, 21, 1]. 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.

In the present investigation, summer pruning weight of different varieties of grape ranged from 1.03 to 5.23 kg/vine while winter pruning weight ranged from 0.46 to 2.76 kg/vine, highest being recorded with the variety Shiraz and lowest in Zinfandel in both the seasons. The pruning weight was found to increase with the advance in the age of the crop. This difference in the pruning weight among the varieties may be attributed to the difference in the vigour of vine and in addition to this, assimilation of carbohydrates due to more number of canes, number of leaves produced and other growth parameters results in more dry matter production. Based on the above results, varieties can be classified as vigorous (Athens, Shiraz, Ruby Red); moderately vigorous (Italia, Bangalore Blue, Gulabi, Symphony, Pusa Navrang and Thompson Seedless); less vigorous (Zinfandel, Sauvignon Blanc and Cabernet Sauvignon). Pruning weight was found to have significant positive correlation with average number of bunches and yield per vine.

A wide range of pruning weight was reported by several workers 0.04 to 2.42 kg/vine (Kadu *et al.*, 2007) [6], 0.44 to 2.93 kg/vine (Havinal *et al.*, 2008) [5], 4.6 to 20.4 kg/vine (Shellie, 2007) [17], 2.51 to 11.09 t ha⁻¹ (Karibasappa and Adsule, 2008) [7], 0.91 to 3.78 kg/vine (Ratnacharyulu, 2010) [14]. However, pruning weight in the present study was less than those reported from South West Idaho (Shellie, 2007) [17] which may be due to tropical conditions prevailing at Hyderabad. The values in the present study were in accordance with the above results.

2. Number of days taken for bud break

The data pertaining to days taken for bud break after winter pruning during 2006-07 and 2007-08 were presented in Table-2. Significant variation was noticed among the varieties, years and interactions with an unaltered trend observed in both the years of study.

The perusal of the pooled data indicates that among the varieties, Pusa Navrang took significantly less number of days to bud break (8.15) and was however at par with Bangalore Blue (8.49) and Chenin Blanc (9.85). The latter was followed by Gulabi (10.09) and Sauvignon Blanc (11.56) and were in the same order. On the other hand, the variety Ruby Red took significantly more number of days to bud break (21.21) followed by Thompson Seedless (17.94) and Cabernet Sauvignon (15.86). Rest of the varieties recorded intermediate values ranging from 13.96 to 15.36 days.

Significant influence on days to bud break after pruning was observed between the years. More number of days (14.69) were taken in the year 2007-08 than in 2006-07 (12.67)

irrespective of the cultivars.

The number of days required for bud break significantly differed from year to year in respect of all varieties. In the year 2006-07, Ruby Red required highest number of days *i.e.*, 20.10 for bud break followed by Thompson Seedless (17.03) and both were at par. Least number of days were required by Pusa Navrang (7.20) closely followed by Bangalore Blue (8.06), Gulabi (9.06) and Chenin Blanc (9.10) which were in same order. The remaining cultivars recorded intermediate number of days for bud break.

Similar trend was observed in the year 2007-08, with slight difference. Ruby Red retained its consistency in requiring time for bud break by recording highest number of days (22.33) and was superior to all others. It was followed by Thompson Seedless (18.86) which in turn was followed by Cabernet Sauvignon (17.30) and both were at par, but superior over others. Cv. Bangalore Blue took least number of days (8.93) closely followed by Pusa Navrang (9.10) and Chenin Blanc (10.60) all were in same order. The rest of the varieties falls between these two extremes.

Interaction between years and cultivars was also significant. In both the years, Ruby Red took highest number of days for bud break, where as Pusa Navrang in 2006-07, showed early bud break (7.20) and Bangalore Blue in 2007-08 exhibited early bud break (8.93).

Bud burst is a varietal character as it marks the beginning of seasonal growth and it is strongly influenced by temperature. Bud bursting time is not easily predictable because its relationship with temperature is very complex. The period of bud sprouting varies with the year and variety. Cvs. Pusa Navrang, Bangalore Blue and Chenin Blanc were the earliest ones to show bud break requiring less than ten days. Whereas Ruby Red needed more than 20 days for bud break. Based on this, the varieties can be classified in to early, mid and late bursting varieties (Bharat, 1997; Mandelli *et al.*, 2003) [2, 9].

Early varieties: Pusa Navrang, Bangalore Blue, Chenin Blanc and Gulabi.

Mid-season varieties: Sauvignon Blanc, Symphony, Shiraz, Zinfandel, Italia and Cabernet Sauvignon.

Late varieties: Ruby Red, Thompson Seedless and Athens.

The data on the parameter clearly indicates that prevailing temperature after pruning effects the time required for bud break in the same variety and the influence of temperature is more than that of variety. Italia at Hyderabad took more than 15 days for bud break and at Venezuela another tropical country, took less than 12 days for bud break (Pina and Bautista, 2004) [12]. Further, lowest number of days taken for bud break was registered during the first year of studies over the second year. This may be due to ideal climatic conditions prevailing during the first year of study *i.e.* warmer climatic conditions observed during the bud break period and also may be due to consecutive higher levels of stored carbohydrate reserves. Such conclusion can also be drawn from earlier studies (Rajaram, 1964; Muthu Krishnan, 1969; Patil, 1968; Kulwal, 1968; Shinde and Patil, 1978; Bharat, 1997; Valor and Bautista, 1997; Seif and Abd Ei-Samad, 2000; Pina and Bautista, 2004) [13, 10, 11, 8, 19, 2, 22, 16, 12]. Mandelli *et al.*, (2003) [9], classified Cabernet Sauvignon as a mid-seasons variety in Brazil, which is in line with the present result wherein Cabernet Sauvignon is grouped under mid-season variety. Some of the research findings on bud burst were reported on

varietal variation in number of days taken for bud break *viz.*, Early (5 days in Bangalore Blue (Muthu Krishnan, 1969) [10]; 7 days (Pusa Navrang) to 13 days (Concord) (Ratnacharyulu, 2010) [14]; 9.4 days in Chenin Blanc (Valor and Bautista, 1997) [22], Mid group (12 days in Anab-e-shahi (Rajaram, 1964) [13]; 12 days in Italia (Pina and Bautista, 2004) [12]; Late group (12 days in Bangalore Purple, 13 days in Ruby Red and 22 days in Hur (Bharat, 1997) [2]; 14 (Gulabi) to 23 days (Pandhari sahebi) (Shinde and Patil, 1978; Kulwal, 1968) [19, 8]. The results of the present study are in conformity with the above findings.

3. Number of Canes per vine

Table-3 furnishes the data recorded on number of canes per vine from which the following observations are made. Significant variation was observed among the varieties during both the years while it was found to be non-significant with respect to their interactions.

With regards to varieties, Cv. Shiraz produced significantly maximum number of canes per vine (54.93) closely followed by Chenin Blanc (53.89) and both were in same order. Cv. Cabernet Sauvignon produced next higher number of canes (47.94) which differed significantly from the above two cultivars and superior to others. Where as Cv. Thompson Seedless recorded the least number of canes (32.91) followed by Italia (34.40), Bangalore Blue (34.61) and Gulabi (35.03), and were in same order but statistically differed from others. The remaining cultivars produced intermediate number of canes per vine.

Significant variation in the number of canes during the different years among the different cultivars was also vivid from the Table. 4. Significantly lesser number of canes (38.72) were recorded in 2006-07 where as, higher number of canes (44.68) were produced in 2007-08. When the individual years are considered, in the year 2006-07, significantly highest number of canes per vine was observed with Chenin Blanc (52.56) closely followed by Shiraz (50.50) and were in same order and superior to other varieties. Thompson Seedless registered least number of canes (30.76) followed by Italia (31.30). The number of canes produced by rest of the cultivars were in between these extremes.

Contrary to the above, in 2007-08, maximum number of canes was noticed in Shiraz (59.36) closely followed by Chenin Blanc (55.23) and were in same order. On the other hand Thompson Seedless with least number of canes (35.06) followed the same trend as that of previous year closely followed by Bangalore Blue (36.66) and Italia (37.50).

The interaction between the varieties and years did not exert significant influence.

4. Cane diameter (mm)

Data on diameter of cane expressed in (mm) were presented in Table-4. The data indicated that varieties, years have exerted significant variations while interactions showed non-significant influence on cane diameter.

The perusal of pooled data indicates that irrespective of the years, the varieties exhibited significant differences in thickness (diameter) of the canes among themselves. Highest cane diameter was observed in Italia (18.60mm) closely followed by Ruby Red (18.14mm), Athens (16.94mm) and Bangalore Blue (16.88mm) and were in same order. On the other side, Cv. Zinfandel produced thinnest canes (10.93mm) closely preceded by Cabernet Sauvignon (12.66 mm) and both were in same order. Rest of the varieties were in the

range of 13.83 to 16.73mm.

Significant difference was noticed with respect to the cane diameter between the years studied. The mean cane diameter was maximum during the second year (16.24 mm) when compared to the first year (14.69 mm). During the first year, maximum diameter of cane was recorded by the variety Italia (16.90 mm) closely followed by Ruby Red (16.83 mm) whereas, minimum was noticed with the variety Zinfandel (9.54 mm). Similar trend was noticed in the second year of investigation.

The interaction effect of years and varieties exhibited non-significant influence on cane diameter.

Besides, pruning weight, the vine vigour can also be judged by the number of canes produced per vine and diameter (Fawzi *et al.*, 1984) [4]. The production of canes and their dimension depends upon vigour of the vine, which in turn depends upon the extent of stored food material in the vine. Vigorous varieties having greater stored food material, produce higher number of canes. It appears that varieties which produced less than 40 canes per vine like Thompson Seedless, Italia, Bangalore Blue, Gulabi and Sauvignon Blanc are less vigorous and those which produced more than 50 canes per vine like Chenin Blanc and Shiraz are highly vigorous and the rest are of medium vigorous type. In the present investigation, the number of canes varied from 32.91 to 54.93 while diameter of cane ranged from 10.93 to 18.60 mm. This difference in number of canes may be due to differences in vigour of the variety. Number of canes found to increase progressively in all the varieties with increase in the age of crop, caused by increased leaf area and vine canopy. Several scientists have recorded similar observations on the number of canes per vine in different cultivars from 3.67 to 41.73 (Kadu *et al.*, 2007) [6] 17.30 to 52.44 (Havinal *et al.*, 2008) [5], 32.33 to 104.00 (Ratnacharyulu, 2010) [14] and cane diameter of 12.61 to 16.21 mm (Reddy *et al.*, 1992) [15] and 4.9 to 6.9 mm (Havinal *et al.*, 2008) [5]. Havinal *et al.*, 2008 [5] reported 52.44 canes per vine in case of Chenin Blanc from Maharashtra which is nearly similar to that of the same variety (53.90) at Hyderabad. However, Cabernet Sauvignon produced higher number of canes (47.95) at Hyderabad than at Ahmadabad (30.20), which may be due to difference in the climate at both places and greater response of Cabernet Sauvignon to climate. The results of the present study are in accordance with the above findings.

5. Shoot length (cm)

The data regarding the Shoot length in different varieties of grape for the two years were furnished in Table-5. Significant variation was observed among the varieties and years.

The pooled data reveal that the shoot length was significantly maximum in Athens (79.16 cm) closely followed by Gulabi (77.00 cm) and Thompson Seedless (75.16 cm) which were at par. whereas least shoot length was recorded in case of Bangalore Blue (53.33 cm) preceded by Ruby Red (60.66 cm) which were independent of each other. The remaining cultivars recorded shoot length in the range of 61.22 cm in Italia to 72.66 cm in Cabernet Sauvignon.

With respect to the years, shoot length was less (65.94 cm) in the first year of experiment than that of second year (68.15 cm). During the first year, maximum shoot length was observed in the variety Athens (77.33 cm) followed by Thompson Seedless (74.66 cm) and Gulabi (74.00 cm) and the latter two were on par to each other, while minimum was recorded by the variety Bangalore Blue (49.00 cm). In the

second year of study (2007-08), same pattern of shoot length was observed in respect of short and longest shoot lengths *i.e.* Athens recorded maximum shoot length (81.00 cm) followed by Gulabi (80.00 cm) and minimum was noticed in Bangalore Blue (57.65 cm). The interaction effects of varieties and years was found to be non-significant.

The vigour of vine can also be judged by means of shoot length besides pruning weight and number of canes. Generally, length of the shoot depends upon the vigour of the variety and extent of pruning. Highly vigorous varieties generally produce longer shoots. However, this does not appear to be true in the present trial. In the present study, it was observed that shoot length varied from 53.33 to 79.16 cm. Highly vigorous varieties (Chenin Blanc and Shiraz) produced comparatively shorter shoots than less vigorous varieties. Thus, it appears that the difference may be due to variety, rather than the vigour of the variety. Since the severity of pruning is similar in respect of all varieties screened, the variation in shoot length of different varieties due to extent of pruning may also be ruled out. This difference in shoot length might be attributed to the number of buds retained on the cane after pruning.

6. Number of leaves

The data recorded on number of leaves were furnished in Table-6. A perusal of the data reveals significant effect with respect to the varieties, years and interaction on number of leaves per vine.

Among the different varieties studied, maximum number of leaves per vine was recorded in Ruby Red (23.66) closely followed by Athens (22.33) and both were in same order and superior to others. Cvs. Sauvignon Blanc and Chenin Blanc are next in line recording 18.66 and 18.50 leaves per plant respectively and were at par. However, less number of leaves were served with Bangalore Blue (9.83), which was independent of the other cultivars.

With respect to the years, there was progressive increase in the number of leaves with increase in the age in all the varieties. The number of leaves increased from 15.07 in the first year to 18.45 in the second year. In the year 2006-07, Athens produced maximum number of leaves (21.00) closely followed by Ruby Red (20.66) and were at par, but superior to others. Minimum number of leaves were produced by Bangalore Blue (9.00) preceded by Italia (10.00) and Gulabi (11.00) and were at par to each other.

In the year 2007-08 unlike in the previous year, Ruby Red registered significantly highest number of leaves (26.66) followed by Athens (23.66) and both were independent of each other and superior to rest of the cultivars. Significantly lowest number of leaves was registered by Bangalore Blue (10.66) as in the previous year, but was independent to others. The interaction between varieties and years indicated significant influence. In both the years, Bangalore Blue recorded minimum number of leaves (9.00 and 10.66) while Athens (21.00) recorded maximum number in the year 2006-08 and Ruby Red in the year 2007-08 recorded maximum number of leaves (26.66).

7. Leaf area (cm²)

The data pertaining to the leaf area in different varieties of grape for both the years were presented in the Table-7. Significant variability was recorded among the varieties and the years but with similar trend was noticed in both the years. The perusal of pooled data reveals that maximum leaf area

was recorded in the variety Bangalore Blue (112.53 cm²) which was significantly superior to rest of the varieties. This was followed by Ruby Red (91.94 cm²), Pusa Navrang (82.56 cm²) and Athens (72.13 cm²). The latter was however, at par with Symphony (70.93 cm²), Thompson Seedless (70.93 cm²), Gulabi (66.50 cm²) and Sauvignon Blanc (64.78 cm²) while, minimum mean leaf area was recorded in Chenin Blanc (42.21 cm²) which in turn was comparable with Zinfandel (46.29 cm²).

When the years are taken into consideration, mean leaf area was found to decrease from first year to second year (74.40 to 63.00 cm²). In 2006-07, maximum leaf area (122.73 cm²) was noticed in Bangalore Blue which was superior over all others. Next in line was Ruby Red (99.26 cm²) which was superior over other cultivars. Minimum leaf area (45.96 cm²) was recorded in Chenin Blanc preceded by Zinfandel (48.66cm²). The rest of the cultivars recorded intermediate values between two extremes.

In the year 2007-08, similar trend was observed. Maximum

leaf area (102.33 cm²) and minimum leaf area (38.46 cm²) was observed in Bangalore Blue and Chenin Blanc respectively.

The varietal and years interaction effects did not showed any significant influence on this trait.

Leaves are the sites of photosynthesis, more the number of leaves on the plant more will be the photosynthesis. In the present study leaf number varied from minimum of 9.83 to a maximum of 23.66 and the leaf area ranged from a minimum of 42.21 cm² in Chenin Blanc to a maximum of 112.53 cm² in cultivar Bangalore Blue. This may be due to the difference in number of canes and vigour of the vine and also may be attributed to inherent varietal character. It was also evident from the data that varieties having less number of leaves had recorded maximum leaf area and vice versa this might be due to translocation of more nutrients to the leaf growth which ultimately results in higher leaf area. The present results are in conformity with the findings of Kadu *et al.*, (2007) [6]; Shirsath (1965) [20]; Chadha and Randhawa (1974) [3].

Table 1: Pruning weight in different wine varieties of grape

Treatments	Variety	Summer pruning weight (kg/vine)			Winter pruning weight (kg/vine)		
		First Year	Second Year	Mean	First Year	Second Year	Mean
Coloured							
T1	Zinfandel	0.73	1.33	1.03	0.26	0.66	0.46
T2	Cabernet Sauvignon	1.33	2.23	1.78	0.63	1.13	0.88
T3	Gulabi	2.73	3.50	3.11	1.30	1.50	1.40
T4	Shiraz	4.56	5.33	4.94	2.13	3.40	2.76
T5	Bangalore Blue	2.36	4.46	3.41	1.53	1.76	1.64
T6	Pusa Navrang	2.16	3.10	2.63	0.56	1.26	0.91
T7	Athens	5.06	5.40	5.23	2.03	2.40	2.21
T8	Ruby Red	3.26	5.26	4.26	0.66	2.00	1.33
White							
T9	Thompson Seedless	1.56	2.33	1.94	0.73	1.60	1.16
T10	Chenin Blanc	1.73	2.33	2.03	0.73	0.83	0.78
T11	Sauvignon Blanc	1.56	2.90	2.23	0.23	1.06	0.64
T12	Italia	2.83	4.63	3.73	1.13	2.20	1.66
T13	Symphony	1.86	2.36	2.11	1.10	1.36	1.23
	Mean	2.43	3.47		1.00	1.62	
	F-test		SEM	CD at 5%	F-test	SEM	CD at 5%
Varieties		*	0.18	0.53	*	0.12	0.34
Years		*	0.07	0.20	*	0.04	0.13
Varieties x Years		NS	0.26	NS	NS	0.17	NS

Table 2: Days taken for bud break in different wine varieties of grape

Treatments	Varieties	First Year	Second Year	Mean
Coloured				
T1	Zinfandel	16.30	14.03	15.16
T2	Cabernet Sauvignon	17.30	14.43	15.86
T3	Gulabi	11.13	9.06	10.10
T4	Shiraz	15.00	13.00	14.00
T5	Bangalore Blue	8.93	8.06	8.50
T6	Pusa Navrang	9.10	7.20	8.15
T7	Athens	17.23	15.20	16.21
T8	Ruby Red	22.33	20.10	21.21
White				
T9	Thompson Seedless	18.86	17.03	17.95
T10	Chenin Blanc	10.60	9.10	9.85
T11	Sauvignon Blanc	12.53	10.60	11.56
T12	Italia	16.63	14.10	15.36
T13	Symphony	15.03	12.90	13.96
	Mean	14.62	12.74	
	F-test		SEM	CD at 5%
Varieties		*	0.68	1.94
Years		*	0.26	0.76
Varieties x Years		*	0.97	2.75

Table 3: Number of canes per vine in different wine varieties of grape

Treatments	Varieties	Number of Canes/vines		
		First Year	Second Year	Mean
Coloured				
T1	Zinfandel	36.56	39.43	37.99
T2	Cabernet Sauvignon	40.83	55.06	47.94
T3	Gulabi	32.93	37.13	35.03
T4	Shiraz	50.50	59.36	54.93
T5	Bangalore Blue	32.56	36.66	34.61
T6	Pusa Navrang	41.46	47.06	44.26
T7	Athens	39.60	49.10	44.35
T8	Ruby Red	37.36	40.86	39.11
White				
T9	Thompson Seedless	30.76	35.06	32.91
T10	Chenin Blanc	52.56	55.23	53.89
T11	Sauvignon Blanc	38.50	45.56	42.03
T12	Italia	31.30	37.50	34.40
T13	Symphony	38.56	42.90	40.73
	Mean	38.72	44.68	
		F-test	SEM	CD at 5%
	Varieties	*	1.01	2.87
	Years	*	0.39	1.12
	Varieties x Years	NS	1.43	NS

Table 4: Canes diameter in different wine varieties of grape

T. No.	Varieties	Diameter of Canes (mm)		
		First Year	Second Year	Mean
Coloured				
T1	Zinfandel	9.54	12.33	10.93
T2	Cabernet Sauvignon	11.76	13.56	12.66
T3	Gulabi	16.33	17.13	16.73
T4	Shiraz	14.93	16.00	15.46
T5	Bangalore Blue	15.30	18.46	16.88
T6	Pusa Navrang	16.20	16.50	16.35
T7	Athens	16.36	17.53	16.94
T8	Ruby Red	16.83	19.46	18.14
White				
T9	Thompson Seedless	15.17	16.16	15.66
T10	Chenin Blanc	13.46	14.20	13.83
T11	Sauvignon Blanc	14.16	14.86	14.51
T12	Italia	16.90	20.30	18.60
T13	Symphony	14.10	14.66	14.38
	Mean	14.69	16.24	
		F-test	SEM	CD at 5%
	Varieties	*	0.65	1.85
	Years	*	0.25	0.72
	Varieties x Years	NS	0.92	NS

Table 5: Shoot length in different varieties of grape

Treatments	Varieties	Shoot length (cm)		
		First year	Second Year	Mean
Coloured				
T1	Zinfandel	68.00	62.65	65.33
T2	Cabernet Sauvignon	69.66	75.66	72.66
T3	Gulabi	74.00	80.00	77.00
T4	Shiraz	64.66	66.33	65.50
T5	Bangalore Blue	49.00	57.65	53.33
T6	Pusa Navrang	59.34	64.60	62.00
T7	Athens	77.33	81.00	79.16
T8	Ruby Red	59.00	62.34	60.66
White				
T9	Thompson Seedless	74.66	75.60	75.16
T10	Chenin Blanc	68.67	70.00	69.33
T11	Sauvignon Blanc	64.65	66.00	65.32
T12	Italia	63.55	60.00	61.72
T13	Symphony	64.68	64.00	64.32

	Mean	65.94	68.15	
		F-test	SEM	CD at 5%
Varieties		*	1.74	4.95
Years		*	0.68	1.94
Varieties x Years		NS	2.47	NS

Table 6: Number of leaves in different wine varieties of grape

Treatments	Varieties	Number of leaves		
		First Year	Second Year	Mean
Coloured				
T1	Zinfandel	14.33	14.66	14.50
T2	Cabernet Sauvignon	13.66	14.33	14.00
T3	Gulabi	11.00	21.66	16.33
T4	Shiraz	14.66	21.33	17.99
T5	Bangalore Blue	9.00	10.66	9.83
T6	Pusa Navrang	13.66	15.33	14.50
T7	Athens	21.00	23.66	22.33
T8	Ruby Red	20.66	26.66	23.66
White				
T9	Thompson Seedless	15.33	20.66	18.00
T10	Chenin Blanc	15.00	22.00	18.50
T11	Sauvignon Blanc	15.00	22.33	18.66
T12	Italia	10.00	20.00	15.00
T13	Symphony	15.66	13.66	14.66
	Mean	14.53	19.00	
		F-test	SEM	CD at 5%
	Varieties	*	0.55	1.58
	Years	*	0.21	0.61
	Varieties x Years	*	0.78	2.23

Table 7: Leaf area in different wine varieties of grape

Treatments	Varieties	Leaf area (cm ²)		
		First Year	Second Year	Mean
Coloured				
T1	Zinfandel	43.93	48.66	46.30
T2	Cabernet Sauvignon	54.70	64.03	59.36
T3	Gulabi	64.70	68.30	66.50
T4	Shiraz	57.00	66.06	61.53
T5	Bangalore Blue	102.33	122.73	112.53
T6	Pusa Navrang	69.93	95.20	82.56
T7	Athens	68.10	76.16	72.13
T8	Ruby Red	84.63	99.26	91.95
White				
T9	Thompson Seedless	65.60	76.26	70.93
T10	Chenin Blanc	38.46	45.96	42.21
T11	Sauvignon Blanc	57.66	71.90	64.78
T12	Italia	46.40	56.53	51.46
T13	Symphony	65.60	76.26	70.93
	Mean	63.00	74.41	
		F-test	SEM	CD at 5%
	Varieties	*	2.74	7.77
	Years	*	1.07	3.05
	Varieties x Years	NS	3.88	NS

Conclusion

There were significant differences in wine varieties with respect to their influence on growth parameters viz., Pruning weight, days taken to bud break, number of canes, cane diameter, shoot length and leaf area. Based on the observations, it became possible to classify the varieties as per the vigorosity and earliness. However, the results clearly indicates the possibility of growing these varieties in Southern Telangana Zone diversifying the grape uses in this zone from table grapes. Further research on standardization of pre-harvest factors (pruning time, harvest time, irrigation, fertigation) is required for production of quality wine and

juice.

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