Performance of different table grape varieties with respect to growth and physiological traits during foundation bud pruning

ABSTRACT :

Grape (*Vitis vinifera* L.) was one of the first fruits cultivated by human since the dawn of civilisation, the fermented product of grapes, wine has probably been an important way of consuming grapes. It is one of the commercially important sub-tropical fruit crop of peninsular India. It is the world's most important fruit in terms of total production and economic stand point. The present research investigates the growth and physiological parameters like pruned biomass, cane length, cane diameter, leaf area, leaf area index, matured canes and chlorophyll content in different table grape varieties over a two year experimentation period (2021-22 and 2022-23) at Horticulture Research and Extension Centre, Tidagundi (Vijayapur), Karnataka. The experiment consisted of 10 treatments laid out in randomized block design with 4 replications. The results highlight the highest fresh weight (2.23 kg/vine), dry weight (1.38 kg/vine), maximum number of canes (53.31), mature canes (48.04), fruitful canes (43.52) per vine, highest leaf area (200.11 cm^2) and leaf area index (3.91) were noted in Thompson Seedless. The maximum cane length (75.90 cm) was recorded in the variety Crimson Seedless. The maximum cane diameter (9.80 mm) was recorded in Red Globe. Manjari Kishmish recorded the maximum chlorophyll content of the leaf (42.92).

Key words: Grape, table varieties, growth, physiological traits, foundation bud pruning

1. INTRODUCTION:

Grape (*Vitis vinifera* L.) is one of the most important commercial fruit crop in India belongs to the family Vitaceae. Grape is cultivated in wide range of climatic zones from temperate to tropical which is believed to have originated near the Caspian Sea. Cultivation of grape in India has acquired greater significance due to its high productivity compared to many other grape producing countries in the world. The major grape-growing states are Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu and the north-western region covering Punjab, Haryana, Delhi, Western Uttar Pradesh, Rajasthan and Madhya Pradesh. India's viticulture industry is a highly profitable farming enterprise, with 72 per cent of production used for table purposes, 22 per cent for raisin, 3.50 per cent for wine and 0.50 per cent for juice. In recent years, viticulture has become one of India's most profitable farming enterprises per unit area of land. Table grapes are meant for consumption while they are in fresh. Table grape should be attractive appearance, bold and elongated berries, crisp pulp, conical shaped bunches, medium sugar and seedlessness is another desirable character. Green seedless varieties are being grown in major part of the India. Whereas, there is increasing demand for coloured seedless varieties in domestic as well as in international market. The research aims to identify suitable table varieties for commercial cultivation in Northern dry zone of Karnataka with respect to growth and physiological traits.

2. MATERIAL AND METHODS

The present investigation on "Performance of different table grape varieties with respect to growth and physiological traits during foundation bud pruning" was carried out during 2021-22 and 2022-23 in the grape vineyard, Horticultural Research and Extension Centre, Tidagundi, Vijayapur district. The research centre is situated at Vijayapur (Tidagundi), which comes under northern dry zone of Karnataka. It is geographically located at a latitude of 16^0 49′ North and longitude 75^0 43′ East. Soils are medium black colour and shallow depth. The pH of the soil range between 7.5 to 8.5. Average annual temperature is 26.5 °C and an average rainfall is 590 mm.

No. of treatments	: 10	No. of replications	: 4
Spacing	: 2.74m × 1.52m	No. of vines/ treatment	: 6

Design: RBD

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Treatment details: 10

Number of varieties: 10

V_1 - Red Globe
V_2 - Fantasy Seedless
V_3 - Crimson Seedless
V_4 - Manjari Shyama (A-18/3)
V_5 – Nana saheb Purple Seedless
V_6 - Sharad Seedless (Check)
V_7 - Merbein Seedless
V_8 - 2A-Clone
V_9– Manjari Kishmish (Kishmish Rozavis White)
V_{10} - Thompson Seedless (Check)

2.1 Pruned bio mass (g/vine)

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After foundation bud-pruning the pruned bio mass was weighed, the fresh weight was recorded. Then it was sun dried for 10 days and dry weight was noted and was expressed in gram (g).

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2.2 Cane length (cm)

With the help of scale, the length of the cane was measured at 30, 60, 90 and 120 days after foundation bud pruning right from the cane's base to the growth tip and expressed in centimetre.

2.3 Cane diameter (mm)

Using vernier callipers, the girth of the cane was measured at 30, 60, 90 and 120 days after foundation bud pruning right from the cane's base and expressed in millimetre (mm).

2.4 Chlorophyll content (SCMR values)

Chlorophyll content of the leaf was recorded at 30, 60, 90 and 120 days after foundation bud pruning in the matured leaf located at fifth node using chlorophyll meter SPAD-502. The values were expressed in SCMR (SPAD chlorophyll meter reading).

2.5 Number of canes/vine

The total number of canes per vine was determined by counting all the canes in the vine.

2.6 Matured canes/vine

The total number of matured canes was determined by counting all the matured canes in the vine.

2.7 Fruitful canes/vine

By counting the flower bud, the total number of fruitful canes per vine was identified and was recorded

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2.8 Leaf area (cm^2)

Leaf area was calculated by the linear method (LBK method) by selecting five leaves per vine and the mean was worked out and expressed in square centimeters. The following is the mathematical formula for calculating it;

$$\text{Leaf area (LA)} = L \times B \times K\ (0.81)$$

Where L = maximum length, B = maximum breadth and K = Correction factor

2.9 Leaf area index (LAI)

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Leaf area index was recorded at 30, 60, 90 and 120 days after foundation bud pruning by LAI-2200C plant canopy analyser by recording PAR below and above the canopy.

3. RESULT AND DISCUSSION

The fresh weight and dry weight of different table grape varieties differed significantly and data is depicted in Table 1 ~~and fig 1~~. Among different table grape varieties, the highest fresh weight (2.23 kg/vine) and dry weight (1.38 kg/vine) was recorded in Thompson Seedless. While, the lowest fresh weight (1.27 kg/vine) and dry weight (0.65 kg/vine) were recorded in Fantasy Seedless. The pruned biomass is regarded as an illustrative indicator of the grape vine's strength. The vigor of the vine determines how differently the pruned biomass varies between cultivars, more vigorous cultivars produce more pruned biomass as a result of the assimilation of carbohydrates from more canes, leaves and other growth factors, which result in more dry matter production. Higher shoot length and leaf density were recorded in this experiment, which can be used to explain the high pruned biomass. The pruned biomass is used to calculate the grapevines' overall growth ~~(Bouard, 1968).~~ Increase in pruning weight was due to increased canopy length and number of shoots per vine. In the present study higher pruned biomass are attributed to vigorous nature of the variety. The results of the present investigation are in close conformity with the findings of ~~Mortensen and Harris (1989),~~ Jayalakshmi *et al*. (2019) and Priyadharshini *et al*. (2023).

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The result on the variation of cane length measured at 30, 60, 90 and 120 days after foundation bud pruning in both the years are presented in Table 2. The cane length at 30 and 60 DAP found insignificant in both the years. Whereas, at 90 DAP, the maximum cane length (66.92 cm) was documented in the variety Manjari Kishmish (V_9) which was statistically comparable with V_6 (66.89 cm), V_{10} (66.59 cm), V_3 (66.33 cm), V_7 (63.58 cm), V_8 (61.74 cm), V_4 (61.04 cm), V_5 (59.80 cm), V_2 (59.72 cm) and the minimum cane length (52.39 cm) was noted in V_1 (Red Globe). At 120 DAP, the maximum cane length (75.90 cm) was recorded in the variety Crimson Seedless (V_3) which was at par with V_1 (74.61 cm), V_7 (73.85 cm), V_6 (73.20 cm), V_9 (73.03 cm), V_2 (72.09 cm), V_8 (71.36 cm) and the minimum cane length (63.18 cm) was recorded in V_1 (Red Globe). The data on the variation in cane diameter measured at 30, 60, 90 and 120 days after foundation bud pruning in both the years are presented in Table 3. At 30 DAP, the maximum cane diameter (4.99 mm) was recorded in Fantasy Seedless and the minimum cane diameter (4.26 mm) was recorded in Nana saheb Purple Seedless.

Table 1. Fresh weight and dry weight of pruned biomass after foundation bud pruning in different table grape varieties

Treatment	Fresh weight (kg/vine)			Dry weight (kg/vine)		
	2021	2022	Pooled	2021	2022	Pooled
V_1	1.56	1.49	1.52	0.85	0.83	0.84
V_2	1.28	1.25	1.27	0.66	0.64	0.65
V_3	1.72	1.67	1.70	0.99	0.98	0.99
V_4	1.67	1.61	1.64	0.96	0.95	0.95
V_5	1.39	1.29	1.34	0.67	0.66	0.66
V_6	1.59	1.54	1.57	0.83	0.82	0.82

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V_7	1.90	1.84	1.87	1.03	1.03	1.03
V_8	2.05	1.97	2.01	1.16	1.16	1.16
V_9	2.15	2.08	2.11	1.28	1.27	1.28
V_{10}	2.27	2.19	2.23	1.39	1.38	1.38
S.Em ±	0.08	0.08	0.07	0.07	0.06	0.06
CD at 5%	0.24	0.25	0.22	0.21	0.19	0.20

V_1 - Red Globe
V_2 - Fantasy Seedless
V_3 - Crimson Seedless
V_4 - Manjari Shyama (A-18/3)
V_5 – Nana saheb Purple Seedless
V_6 - Sharad Seedless (Check)
V_7 - Merbein Seedless
V_8 - 2A-Clone
V_9– Manjari Kishmish (Kishmish Rozavis White)
V_{10} - Thompson Seedless (Check)

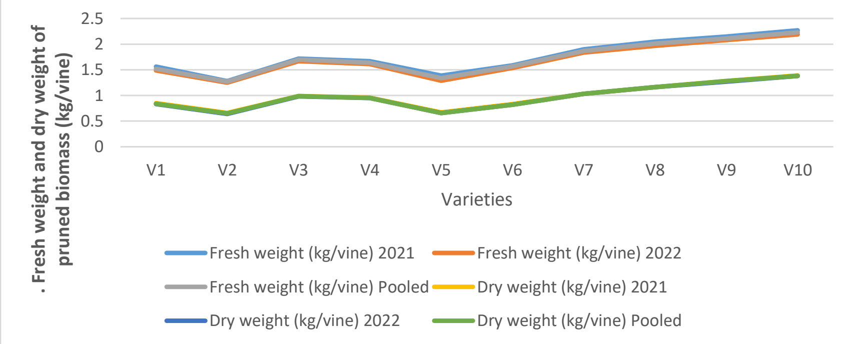

Fig 1. Fresh weight and dry weight of pruned biomass after foundation bud pruning in different table grape varieties

At 60 DAP, the maximum cane diameter (7.75 mm) was recorded in Red Globe and the minimum cane diameter (6.75 mm) was recorded in Nana saheb Purple Seedless. At 90 DAP, the maximum cane diameter (8.85 mm) was recorded in Red Globe and the minimum cane diameter (7.58 mm) was recorded in Sharad Seedless. At 120 DAP, the maximum cane diameter (9.80 mm) was recorded in Red Globe and the minimum cane diameter (8.54 mm) was recorded in Nana saheb Purple Seedless during foundation bud pruning.

Another criteria to judge the vine vigour was the highest cane length and cane diameter as well as internodal length might be due to better absorption and accumulation of nutrients in the tissue. The vines with thicker canes and shorter internodes are known to bear a good bunch. Better accumulation of carbohydrates food reserves, which are pre requisites for flower bud initiation as it is reflecting in our findings. These results are in accordance with the findings of Ghugare and Mukherjee (1967), Srivastava and Soni (1989), Rangareddy (1996), Somkuwar and Ramteke (2006), Chalak (2008) and Jayalakshmi *et al*. (2019).

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At 120 DAP, the maximum internodal length (5.79 cm) of the cane was recorded in Crimson Seedless and the minimum internodal length (5.18 cm) of the cane was recorded in

Nanasaheb Purple Seedless (Table 4). The variation in the internodal length of the cane might be due to genotypic character of the variety. Vigorous varieties produces more cane length and shoot length by increased intermodal length whereas, less vigorous varities produces shorter internodes by accumulating higher carbohydrate reserve for flower bud initiation. The results are in line with the findings of Shubhangini (2016), Jayalakshmi *et al*. (2019), Anand (2021) and Priyadharshini *et al*. (2023).

The maximum internodal girth of the cane (9.52 mm) and the minimum internodal girth of the cane (8.09 mm) was recorded in Nanasaheb Purple Seedless (Table 5). This might be due to vigorous varieties produces the maximum number of canes per vine results in increased competition for absorption of food material among the canes and fruiting shoots. While, less vigorous varieties produces minimum number of canes results in the reduced sink and allowed greater allocation of assimilates. This is mainly attributed due to more photosynthates were partitioned rigorously during peak vegetative growth phase. Hence, it was recorded increase in girth of the cane as well as girth of the fruiting shoot. The results are in harmony with Somkuwar and Ramteke, 2006; Chalak (2008), Anand (2021) and Priyadharshini *et al*. (2023).

The maximum number of canes per vine determines the vigour of the vine. The highest number of canes (53.31), mature canes (48.04) and fruitful canes (43.52) per vine were noted in Thompson Seedless and the lowest number of canes (36.56) and mature canes per vine (32.15) in Red Globe whereas the lowest fruitful canes (16.85) in Nanasaheb Purple Seedless (Table 6 ~~and fig 2).~~

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Table 2. Cane length after foundation bud pruning in different table grape varieties

Treatment	Cane length (cm) after foundation bud pruning											
	30 DAP			60 DAP			90 DAP			120 DAP		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
V_1	17.34	15.49	16.41	36.57	40.61	38.59	49.35	55.42	52.39	61.26	65.09	63.18
V_2	18.23	15.28	16.75	45.19	41.33	43.26	58.19	61.26	59.72	69.82	74.35	72.09
V_3	17.42	21.36	19.39	39.68	45.39	42.53	65.27	67.39	66.33	73.32	78.48	75.90
V_4	16.64	20.31	18.48	45.24	40.28	42.76	63.26	58.82	61.04	72.28	70.79	71.54
V_5	21.24	17.43	19.33	39.32	43.08	41.20	55.25	64.35	59.80	69.44	73.17	71.31
V_6	18.51	19.39	18.95	41.45	46.39	43.92	65.56	68.22	66.89	71.93	74.47	73.20
V_7	18.43	20.75	19.59	41.38	47.42	44.40	62.29	64.87	63.58	74.34	73.37	73.85
V_8	18.02	19.45	18.73	45.58	44.19	44.88	63.28	60.21	61.74	69.42	73.29	71.36
V_9	21.44	19.34	20.39	43.66	46.32	44.99	65.35	68.49	66.92	74.20	71.86	73.03
V_{10}	22.87	20.34	21.60	44.57	47.19	45.88	69.41	63.78	66.59	75.38	73.85	74.61
S.Em ±	1.67	1.55	1.31	2.34	2.53	1.66	3.29	3.32	2.51	2.65	2.36	1.40
CD at 5%	N S	N S	N S	N S	N S	N S	9.55	NS	7.54	7.96	NS	4.22

NS: Non significant
DAP- Days after pruning
V_1 - Red Globe
V_2 - Fantasy Seedless
V_3 - Crimson Seedless
V_4 - Manjari Shyama (A-18/3)
V_5 - Nanasaheb Purple Seedless
V_6 - Sharad Seedless (Check)
V_7 - Merbein Seedless
V_8 - 2A-Clone
V_9–Manjari Kishmish (Kishmish Rozavis White)
V_{10} - Thompson Seedless (Check)

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Table 3. Cane diameter after foundation bud pruning in different table grape varieties

Treatment	Cane diameter (mm) after foundation bud pruning											
	30 DAP			60 DAP			90 DAP			120 DAP		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
V_1	4.51	5.43	4.97	7.56	7.93	7.75	8.62	9.09	8.85	9.19	10.42	9.80
V_2	5.12	4.87	4.99	7.18	6.81	7.00	7.91	7.63	7.77	8.81	8.68	8.74
V_3	4.62	4.31	4.47	6.98	7.47	7.22	7.52	7.88	7.70	9.14	8.58	8.86
V_4	4.27	4.43	4.35	7.11	6.59	6.85	7.89	7.56	7.73	8.89	9.37	9.13
V_5	4.38	4.15	4.26	6.56	6.94	6.75	7.58	8.12	7.85	8.62	8.46	8.54
V_6	4.53	4.38	4.45	6.86	7.22	7.04	7.34	7.83	7.58	8.78	8.46	8.62
V_7	4.30	4.48	4.39	7.49	7.16	7.33	7.94	8.32	8.13	8.53	9.12	8.83
V_8	4.63	4.24	4.44	6.81	7.32	7.06	7.59	8.13	7.86	8.83	8.40	8.62
V_9	4.36	4.46	4.41	7.34	7.08	7.21	8.52	8.05	8.29	8.96	9.08	9.02
V_{10}	4.84	4.12	4.48	7.42	6.98	7.20	8.33	7.53	7.93	9.55	9.29	9.42
S.Em ±	0.20	0.17	0.15	0.15	0.17	0.13	0.17	0.17	0.14	0.17	0.15	0.12
CD at 5%	NS	0.51	0.45	0.44	0.49	0.39	0.50	0.51	0.42	0.50	0.45	0.36

NS: Non significant
DAP- Days after pruning
V_1 - Red Globe
V_2 - Fantasy Seedless
V_3 - Crimson Seedless
V_4 - Manjari Shyama (A-18/3)
V_5 - Nanasaheb Purple Seedless
V_6 - Sharad Seedless (Check)
V_7 - Merbein Seedless
V_8 - 2A-Clone
V_9–Manjari Kishmish (Kishmish Rozavis White)
V_{10} - Thompson Seedless (Check)

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Table 4. Internodal length after foundation bud pruning in different table grape varieties

Treatment	Internodal length (cm) after foundation bud pruning											
	30 DAP			60 DAP			90 DAP			120 DAP		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
V_1	4.13	3.92	4.02	4.88	4.57	4.73	5.18	4.92	5.05	5.85	5.27	5.56
V_2	3.51	3.85	3.68	4.36	4.65	4.50	4.88	5.12	5.00	5.58	5.79	5.68
V_3	3.48	3.61	3.55	4.11	4.75	4.43	4.81	5.27	5.04	5.68	5.89	5.79
V_4	3.57	3.97	3.77	3.99	4.67	4.33	4.46	5.33	4.89	5.11	5.79	5.45
V_5	3.43	3.87	3.65	3.93	4.54	4.24	4.34	4.97	4.66	4.86	5.49	5.18
V_6	3.62	3.24	3.43	4.65	4.31	4.48	5.18	4.83	5.01	5.96	5.39	5.67
V_7	3.56	3.98	3.77	4.36	4.62	4.49	4.98	5.37	5.17	5.59	5.90	5.75
V_8	3.28	3.84	3.56	4.09	4.72	4.40	4.76	5.20	4.98	5.35	5.85	5.60
V_9	3.71	3.54	3.63	4.83	4.35	4.59	5.37	5.15	5.26	5.93	5.43	5.68
V_{10}	3.35	3.83	3.59	4.18	4.58	4.38	4.61	5.27	4.94	5.45	5.92	5.68
S.Em ±	0.14	0.12	0.09	0.11	0.12	0.07	0.12	0.16	0.09	0.12	0.15	0.09
CD at 5%	0.42	0.36	0.27	0.33	NS	0.21	0.36	NS	0.27	0.36	0.45	0.27

NS: Non significant DAP- Days after pruning
V_1 - Red Globe V_6 - Sharad Seedless (Check)
V_2 - Fantasy Seedless V_7 - Merbein Seedless
V_3 - Crimson Seedless V_8 - 2A-Clone
V_4 - Manjari Shyama (A-18/3) V_9–Manjari Kishmish (Kishmish Rozavis White)
V_5 - Nanasaheb Purple Seedless V_{10} - Thompson Seedless (Check)

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Generally vigorous varieties produces more ~~number of~~ canes per vine than the less vigorous varieties. The difference in the cane maturity and fruitful canes may be attributed to difference in vine vigour and genetic nature of the cultivars. The maximum number of fruitful canes per vine serve as a pre-requisite for determining the vigor of the vine which ultimately leads to production of fruiting spurs and renewal spurs. Similar findings were reported by Ratnacharyulu (2010), Soni *et al*. (2019) and Priyadharshini *et al*. (2023).

Physiologically active leaves are responsible for influencing the photosynthetic efficiency and transport of photosynthates required for the growth and developmental activity of reproductive structures which largely influence ~~the~~ crop productivity. The highest leaf area (200.11 cm^2) and leaf area index (3.91) was noted in Thompson Seedless and the lowest leaf area (183.54 cm^2) and leaf area index (3.68) was recorded in Nanasaheb Purple Seedless after foundation bud pruning (Table 7 and 8). Vigorous varieties produce more shoot length, the maximum number of leaves per shoot and t~~heir~~ by more leaf area and leaf area index which was attributed to inherent varietal character. As the number of canes and number of shoots per vine increased, potentially leaf count, the leaf area and LAI also increased because of increase in number of leaves per vine which contributes to elevated LAI. Similar findings were reported by ~~Edson *et al.,* (1993), Gicheol and Chool (1999),~~ Chougule (2004), Brandon *et al.,* (2012) and Somkuwar *et al.* (2012).

At 120 DAP, Manjari Kishmish recorded the maximum chlorophyll content of the leaf (42.92) which was at par with Thompson Seedless (42.70), Manjari Shyama (42.44), 2A-Clone (42.28), Crimson Seedless (42.27), Red Globe (41.44) and Merbein Seedless (42.12). The minimum chlorophyll content of the leaf (39.95) was recorded in Nanasaheb Purple Seedless (Table 9). Which were attributed to sufficient carbohydrates available due to more number of canes and shoots helped in better vegetative growth and accelerated the photosynthetic efficiency of the crop and it is genotypic dependent and environmental effects. It was also due to the structure of the leaves, including size, thickness, shape and surface area, which affects the distribution of chlorophyll. Furthermore, environmental conditions such as light intensity, temperature, humidity and nutrient availability can have varied impacts on chlorophyll production and degradation, causing different grape varieties to respond differently and exhibit variations in SPAD readings. The differences in nutrient uptake among these varieties play a crucial role as their ability to absorb and utilize essential nutrients required for chlorophyll production can lead to difference in SPAD values. Similar results were noted by Slavtcheva *et al*. (1996), Kumar (1999), Ashwini *et al*. (2016) and Shruti *et al*. (2022).

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4. CONCLUSION:

Based on the findings, Thompson Seedless recorded highest growth and physiological parameters which are going to influence on the yield and yield attributing characters by managing the source and sink ratio.

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Table 5. Internodal girth of the cane after foundation bud pruning in different table grape varieties

Treatment	Internodal girth (mm) of the cane after foundation bud pruning											
	30 DAP			60 DAP			90 DAP			120 DAP		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
V_1	5.26	4.34	4.80	7.57	7.13	7.35	9.15	8.35	8.75	10.12	8.92	9.52
V_2	4.61	4.88	4.75	6.43	6.84	6.64	7.24	7.46	7.35	8.34	8.36	8.35
V_3	4.17	4.31	4.24	7.15	6.52	6.84	7.45	7.28	7.37	9.16	8.83	9.00
V_4	4.06	3.97	4.01	6.32	6.87	6.60	7.18	7.54	7.36	8.95	8.34	8.65
V_5	3.75	4.15	3.95	6.42	6.33	6.38	7.72	7.22	7.47	8.26	7.92	8.09
V_6	3.97	4.23	4.10	6.96	6.45	6.71	7.36	6.89	7.13	8.58	7.96	8.27
V_7	4.14	3.96	4.05	6.72	7.16	6.94	7.93	7.44	7.69	8.94	8.32	8.63
V_8	3.94	4.22	4.08	7.16	6.47	6.82	7.86	7.35	7.61	8.56	7.94	8.25
V_9	4.15	3.85	4.00	6.74	7.14	6.94	7.73	8.18	7.96	8.94	8.61	8.78
V_{10}	3.93	4.42	4.18	6.58	6.96	6.77	8.14	7.82	7.98	9.25	8.95	9.10
S.Em ±	0.17	0.14	0.15	0.15	0.16	0.14	0.17	0.19	0.17	0.24	0.22	0.25
CD at 5%	0.51	0.42	0.46	0.45	0.48	0.44	0.51	0.57	0.50	0.72	0.66	0.76

DAP- Days after pruning

V_1 - Red Globe V_6 - Sharad Seedless (Check)

V_2 - Fantasy Seedless V_7 - Merbein Seedless

V_3 - Crimson Seedless V_8 - 2A-Clone

V_4 - Manjari Shyama (A-18/3) V_9–Manjari Kishmish (Kishmish Rozavis White)

V_5 - Nanasaheb Purple Seedless V_{10} - Thompson Seedless (Check)

UNDER PEER REVIEW

Table 6. Number of canes per vine, mature canes and fruitful canes during fore pruning in different table grape varieties

Treatment	Number of canes/vine			Mature canes/vine			Fruitful canes/vine		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
V_1	41.79	31.34	36.56	37.00	27.29	32.15	31.25	25.04	28.15
V_2	37.08	40.33	38.71	31.25	35.04	33.15	24.75	23.58	24.17
V_3	47.55	43.38	45.46	42.50	39.33	40.92	35.75	32.00	33.88
V_4	43.25	45.04	44.15	39.00	40.38	39.69	32.75	37.17	34.96
V_5	37.29	43.09	40.19	32.25	37.46	34.85	15.25	18.46	16.85
V_6	42.25	38.00	40.13	36.75	33.04	34.90	28.75	28.25	28.50
V_7	42.25	41.25	41.75	37.50	36.46	36.98	33.31	30.79	32.05
V_8	45.00	45.92	45.46	40.13	41.17	40.65	35.13	36.33	35.73
V_9	47.83	51.75	49.79	43.31	47.08	45.20	38.81	44.92	41.87
V_{10}	51.34	55.29	53.31	46.25	49.83	48.04	42.25	44.79	43.52
S.Em ±	2.52	2.53	2.29	2.50	2.60	2.29	2.32	2.37	1.99
CD at 5%	7.58	7.59	6.87	7.51	7.81	6.88	6.96	7.12	5.97

V_1 - Red Globe **V_6** - Sharad Seedless (Check)
V_2 - Fantasy Seedless **V_7** - Merbein Seedless
V_3 - Crimson Seedless **V_8** - 2A-Clone
V_4 - Manjari Shyama (A-18/3) **V_9**–Manjari Kishmish (Kishmish Rozavis White)
V_5 - Nanasaheb Purple Seedless **V_{10}** - Thompson Seedless (Check)

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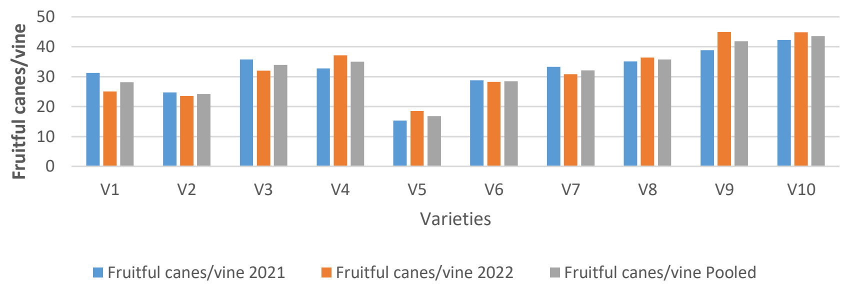
Fig 2. Fruitful canes during fore pruning in different table grape varieties



UNDER PEER REVIEW

Table 7. Leaf area after foundation bud pruning in different table grape varieties

Treatment	Leaf area (cm^2) after foundation bud pruning											
	30 DAP			60 DAP			90 DAP			120 DAP		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
V_1	52.47	48.27	50.37	88.33	82.24	85.28	139.43	152.29	145.86	195.24	188.72	191.98
V_2	44.21	36.38	40.30	85.49	81.32	83.40	142.31	136.17	139.24	179.72	189.56	184.64
V_3	38.36	43.35	40.86	89.14	80.23	84.69	150.27	142.32	146.30	192.03	184.46	188.24
V_4	39.23	45.37	42.30	85.24	81.37	83.30	145.37	148.34	146.85	187.13	192.67	189.90
V_5	40.46	38.42	39.44	85.27	78.56	81.91	141.21	135.14	138.17	181.18	185.91	183.54
V_6	38.62	41.30	39.96	75.31	85.12	80.21	160.19	145.58	152.89	193.37	183.44	188.40
V_7	38.21	42.26	40.23	85.47	89.13	87.30	152.40	165.74	159.07	189.60	195.66	192.63
V_8	40.32	45.07	42.69	88.29	91.25	89.77	162.18	155.08	158.63	186.62	194.80	190.71
V_9	48.32	51.51	49.92	92.19	85.10	88.65	160.35	168.19	164.27	195.32	201.99	198.65
V_{10}	56.06	47.20	51.63	88.87	91.31	90.09	165.29	169.52	167.41	196.71	203.51	200.11
S.Em ±	2.21	2.74	2.10	2.19	2.85	2.06	2.59	4.09	2.11	3.80	4.47	2.89
CD at 5%	6.64	8.22	6.31	6.58	8.55	6.18	7.78	12.27	6.33	11.40	13.42	8.67

DAP- Days after pruning

V_1 - Red Globe
V_6 - Sharad Seedless (Check)
V_2 - Fantasy Seedless
V_7 - Merbein Seedless
V_3 - Crimson Seedless
V_8 - 2A-Clone
V_4 - Manjari Shyama (A-18/3)
V_9–Manjari Kishmish (Kishmish Rozavis White)
V_5 - Nanasaheb Purple Seedless
V_{10} - Thompson Seedless (Check)

UNDER PEER REVIEW

Table 8. Leaf area index after foundation bud pruning in different table grape varieties

Treatment	Leaf area index after foundation bud pruning											
	30 DAP			60 DAP			90 DAP			120 DAP		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
V_1	2.21	2.28	2.25	3.22	3.15	3.19	3.65	3.51	3.58	3.86	3.81	3.84
V_2	2.12	2.19	2.16	3.09	3.01	3.05	3.52	3.45	3.49	3.78	3.76	3.77
V_3	2.32	2.35	2.34	3.31	3.25	3.28	3.72	3.58	3.65	3.89	3.85	3.87
V_4	2.28	2.31	2.30	3.28	3.26	3.27	3.68	3.55	3.62	3.85	3.81	3.83
V_5	2.09	2.02	2.06	2.95	2.91	2.93	3.41	3.38	3.40	3.69	3.66	3.68
V_6	2.11	2.13	2.12	3.05	2.95	3.00	3.48	3.51	3.50	3.72	3.68	3.70
V_7	2.13	2.17	2.15	3.16	3.17	3.17	3.55	3.52	3.54	3.71	3.69	3.70
V_8	2.25	2.28	2.27	3.21	3.18	3.20	3.64	3.58	3.61	3.82	3.80	3.81
V_9	2.29	2.36	2.33	3.28	3.22	3.25	3.75	3.66	3.71	3.89	3.84	3.87
V_{10}	2.32	2.39	2.36	3.35	3.28	3.32	3.78	3.71	3.75	3.93	3.89	3.91
S.Em ±	0.02	0.02	0.01	0.02	0.02	0.01	0.03	0.03	0.02	0.05	0.05	0.05
CD at 5%	0.06	0.06	0.03	0.06	0.06	0.03	0.09	0.09	0.06	0.15	0.15	0.15

DAP- Days after pruning

V_1 - Red Globe V_6 - Sharad Seedless (Check)
V_2 - Fantasy Seedless V_7 - Merbein Seedless
V_3 - Crimson Seedless V_8 - 2A-Clone
V_4 - Manjari Shyama (A-18/3) V_9–Manjari Kishmish (Kishmish Rozavis White)
V_5 - Nanasaheb Purple Seedless V_{10} - Thompson Seedless (Check)

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Table 9. Chlorophyll content (SPAD Readings) of the leaf after fore pruning in different table grape varieties

Treatment	Chlorophyll content (SCMR) after fore pruning											
	30 DAP			60 DAP			90 DAP			120 DAP		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
V_1	31.16	30.35	30.75	33.36	33.56	33.46	38.27	38.53	38.40	41.12	41.76	41.44
V_2	32.26	31.33	31.79	35.15	35.89	35.52	39.15	38.43	38.79	41.83	40.48	41.15
V_3	32.60	32.14	32.37	35.08	34.68	34.88	38.56	38.85	38.71	42.37	42.17	42.27
V_4	31.43	31.89	31.66	35.56	34.83	35.20	38.16	37.92	38.04	42.14	42.73	42.44
V_5	29.55	29.82	29.68	32.46	32.52	32.49	36.49	35.76	36.13	40.13	39.77	39.95
V_6	30.38	30.11	30.24	33.12	33.55	33.33	37.18	37.42	37.30	40.85	40.58	40.71
V_7	31.22	31.64	31.43	34.68	33.89	34.28	37.35	37.45	37.40	42.17	42.07	42.12
V_8	30.73	31.19	30.96	34.15	34.67	34.41	37.14	36.57	36.86	42.62	41.95	42.28
V_9	32.13	31.92	32.03	35.68	35.28	35.48	38.55	38.61	38.58	43.34	42.51	42.92
V_{10}	32.04	31.26	31.65	35.62	35.13	35.37	38.45	38.02	38.23	43.14	42.26	42.70
S.Em ±	0.64	0.52	0.48	0.46	0.54	0.43	0.44	0.44	0.37	0.63	0.52	0.53
CD at 5%	NS	1.56	1.44	1.38	1.62	1.29	1.32	1.31	1.11	1.89	1.56	1.59

NS: Non significant DAP- Days after pruning

V_1 - Red Globe V_6 - Sharad Seedless (Check)

V_2 - Fantasy Seedless V_7 - Merbein Seedless

V_3 - Crimson Seedless V_8 - 2A-Clone

V_4 - Manjari Shyama (A-18/3) V_9–Manjari Kishmish (Kishmish Rozavis White)

V_5 - Nanasaheb Purple Seedless V_{10} - Thompson Seedless (Check)

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Write references according to journals need.

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