Journal of Agrometeorology 15 (1) : 79-81 (June 2013)

Short communication

Influence of cane density on microclimate of canopy, growth, yield and quality of wine grapes

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Grape (*Vitis vinifera* L.) is an important fruit crop in India. India is emerging fast as a major grape growing country in the world. Maharashtra is leading state in respect of area 60,000 ha with an annual production of 16.0 lakh tonnes; while the grape area in India 82.0 lakh ha with an annual production of 27.0 lakh tonnes and productivity is 22.0 t ha^{-1} (Anon. 2007). In recent years the area and production is increasing; however, the productivity is decreasing because of increasing the frequency of natural climatic hazards viz., cold wave, heat wave, heavy rainfall and cloudy condition.

Weather elements as well as soil factors have significant influence on growth, berry development of grape, its quality and yiled. The cultivars which can produce satisfactory wine in certain locality are termed as wine grapes, which have high acidity and low sugar content. The important grape varieties suitable for wine making are Shiraz, Merlot, Chenin Blanc and Sauvignon Blanc which are grown and utilized for wine industries in Marathwada region.

The experiment was carried out during 2009-2010 on nine years old 'Shiraz Grafted Dogridge' vines with spaced at 2.4 X 0.9 m^2 in Kolpa, Taluqa in Latur district of Maharashtra. The experiment was laid out in randomized block design with four replications and five treatments (T1 ; 18 canes per vine, T2 ; 21 canes per vine, T3 ; 24 canes per vine, T4; 27 canes per vine and T5 ; 30 canes per vine). The study was conducted in two parts. Physiological characteristics were studied in vineyard and berry analysis was carried out at the Central Instrumentation Cell, Department of Agriculture Chemistry and Soil Science, College of Agriculture, Latur.

Five bunches of each treatment were harvested at peak maturity from orchard. The bunch samples were immediately put into perforated plastic bags. The samples were immediately brought to the laboratory and stored in refrigerator (below 5.0 ^{0}C) for 24 hours. Then washed twice with distilled water and then the berries were taken for analysis.

Canopy temperature of each vine was measured daily at 14: 30 hrs. by using Everest Infra-red thermometer (model 6110.4 ZL) at the top layer (1.5 m from ground level) of canopy, middle layer (1.2 m from ground level) of canopy and bottom or lower layer (0.9 m from ground level).

A digital electronic thermo hygrometer was used to measure relative humidity at different layers of vine canopy and observation was taken twicely at 07:30 hrs and 14:30 hrs daily.

The leaf area was computed by using a leaf area meter. The average leaf area of each treatment was recorded. The leaves were classified on the basis of area as given by Chadha and Randhawa, (1974) :

Small	:	< 100 dm^2
Medium	:	101-150 dm^2
Large	:	151-200 dm^2
Very large	:	> 200 dm^2

Leaf area index (LAI) of each vine of treatment was computed by

$$\text{Leaf area index} = \frac{\text{Total leaf area per vine (dm}^2\text{)}}{\text{Ground area per vine (dm}^2\text{)}}$$

Yield attributing observations viz., number of branches per vine, weight of bunches, yield per vine (kg) and yield per ha (Mt ha^{-1}) quality attributes like TSS and acidity were determined.

Acidity of juice was calculated by formula given by Ranganna, (1986).

$$\text{Titratable acidity (\%)} = \frac{\text{N/NaOH used x 0.0064}}{\text{Volume of sample used}} \text{ x 100}$$

The data were analyzed statistically as per the methods outlined by Panse and Sukhatme (1985) with the help of statically computerized programme.

The growth and microclimate were significantly influenced by cane density. The highest leaf area (101.04 dm^2) was observed in treatment T_5 i.e. 30 canes per vine.

Table 1 : Effect of cane density on microclimate and correlation between cane density and growth, yield and quality attributes of wine grape

Treat-ment	Canopy density per vine	Growth character		Yield character				Quality character		Range of canopy Temp.(°C)			Range of canopy RH (%)		
		Leaf area (dm^2 per vine)	LAI	No. of branches per vine	Weight of bunch (g)	Yield per wine (kg)	Yield (Mt ha^{-1})	T.S.S. (°B)	Acidity (%)	Top layer	Middle layer	Lower layer	Top layer	Middle layer	Lower layer
T_1	18 canes	89.90	1.79	9.45	121.59	1.19	5.51	20.81	0.84	23.8-34.5	24.5-35.3	25.2-36.1	23-45	24-51	27-61
T_2	21 canes	91.60	1.84	12.30	127.18	1.57	7.27	21.33	0.87	23.6-34.4	24.3-35.2	25.0-36.0	25-49	28-55	30-68
T_3	24 canes	94.67	1.95	14.60	133.41	1.95	9.10	21.92	0.89	23.5-34.3	34.2-35.1	24.9-35.9	28-53	31-63	33-72
T_4	27 canes	98.06	2.09	18.27	133.83	2.55	11.80	22.64	0.92	23.3-34.2	24.0-34.9	24.7-35.7	29-57	32-69	34-77
T_5	30 canes	101.04	2.18	21.85	138.52	2.59	11.99	23.20	0.93	23.2-34.0	23.9-34.8	24.5-35.5	31-61	35-73	38-82
S.E. ±		0.42	0.009	0.98	1.92	0.17	0.16	0.13	0.0034						
CD		1.31	0.03	3.03	5.91	0.52	0.50	0.40	0.010						

The significant difference was observed in leaf area due to number of canes per vine within the treatments. The amount of foliage per vine was the principal factor in the fruit weight, number of bunches and quality where as the leaf area was decreased due to less expose to sunlight and competition for nutrients. Slavtcheva *et al.* (1997) reported that the positive correlation was found between yield per vine and photosynthetic rate and also between grape yield and leaf area per vine.

The highest leaf area index (2.18) was observed in treatment T_5 i.e. 30 canes per vine. The results are in conformity with those reported by Kingston *et al.* (1989)

The significant differences in number of bunches per vine was observed due to varying cane densities. The number of bunches per vine (21.85) in treatment T_5 i.e. 30 canes per vine were found significantly superior over all the treatments. There was linear increase in number of bunches per vine with increase in number of canes per vine, which might be due to the increased bearing area on vines. Similar results were reported by Reynolds *et al.* (1986).

The maximum weight of bunch was observed in treatment T_5 i.e. 30 canes per vine (138.52 g). The results differences in the weight of bunch were due to variations in number of canes per vine amongst the treatments. This might be due to number of canes per vine which resulted in the increased size, weight and number of berries per bunch.

The significant differences in yield per vine to number of canes per vine was between the treatments. The yield per vine in treatment T_5 i.e. 30 canes per vine (2.59 kg vine^{-1} and 11.99 Mt ha^{-1}) was found significantly superior over all treatments except treatment T_4 i.e. 27 canes per vine (2.55 vine^{-1} and 11.80 Mt ha^{-1}). Thus, a linear increase in yield per vine with increase in number of canes per vine was observed. This was mainly due to greater number of bunches per vine and because of increased bearing area. Mohammed *et al.* (1993) reported that, the yield per vine increased with increase in number of canes.

T.S.S. percentage increased significantly with increased number of canes per vine. It is might be due to better availability of nutrition or increased availability of metabolites. The acidity in treatment T_5 i.e. 30 canes per vine (0.93 %) was found significantly superior over all the treatments except treatment T_4 i.e. 27 canes per vine (0.92 %).

Microclimatic study in canopy management of wine grapes showed that, the increased number of canes per vine decreased the canopy temperature and increased relative humidity. The treatment T_5 i.e. 30 canes per vine with planting distance 2.4 X 0.9 m^2 was found significant for plantation of wine grapes. However, there is scope to increase the number of canes per vine and for such type of concurred recommendation there is need to undertake more advance study on these aspects.

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Received : May 2012 ; Accepted : October 2012

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