



Interaction effect of budload, fertilizer and micronutrient application on vegetative and pomological traits of grape cv. Sahebi

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ABSTRACT

The study was conducted in model grapevine orchard of Department of Horticulture at Ganderbal (J&K) for two consecutive years. The investigation comprised of 27 treatment combinations formed by combining three bud load levels (B₁-96 buds/vine), (B₂ -128 buds/ vine) and (B₃-160 buds/vine), three fertilizer doses F₁=FYM (50 kg/vine) + recommended dose (NPK: 555, 227, 470g/vine), F₂=FYM (50 kg/vine)+ 2 times recommended dose (NPK: 1110, 454, 940g/vine), F₃=FYM (50 kg/vine)+ 3 times recommended dose (NPK: 1665, 681, 1410g/vine) and three micronutrient levels viz. M₁ (Solubor 0.1%), M₂ (ZnSO₄ 0.4%) and M₃ (Solubor 0.1% + ZnSO₄ 0.4%) replicated three times with a double plot size in a completely randomized block design. The interaction B₂F₂M₁ (Bud load B₂- 128 buds/vine, fertilizer dose F₂ (FYM-50 kg/vine + 2 times recommended dose-NPK: 1110, 454, 940 g/vine) and micronutrient M₁- (Solubor 0.1%)) recorded the maximum percentage of berry weight, berry length, TSS, total sugars and minimum percentage of shot berries . However maximum leaf area and number of leaves was exhibited by the interaction B₁M₃F₃ and B₂M₁F₁ respectively. Thus the interaction B₂M₁F₂ proved to be best in affecting the vegetative and pomological traits of grape cv. Sahebi

Keywords: Budload, fertilizer, micronutrient, sahebi, vegetative

Grapevine (*Vitis vinifera* L.) belonging to family *Vitaceae* is considered one of the most important perennial fruit crops in the world. It has originated somewhere between the Black and the Caspian Sea. The cultivation of grapes all over the world vary based on cultivation suitability, disease resistance, color, taste, texture and having seeds or seedless (Santos *et al.*, 2020). There are currently between 8000 and 10,000 cultivars of *V. vinifera* grapes in the world that are of commercial significance for raisin, and table grape production (McGovern *et al.*, 2017). Grapes are rich source of vitamin B, vitamin K, copper and fiber and relatively low in calories. The grape skin and seeds have richest concentrations of nutrients and antioxidants, including resveratrol. They possess antimicrobial, anti-inflammatory, and anti-carcinogenic activities and have wide applications in food and nutraceutical industries. More than 80 per cent of grapes produced worldwide are used for wine making while 10 per cent goes into preparation of raisin and food

processing industries and the rest is taken for table purpose. World grape production is 77.5 million tones on an area of about 7.5 million hectares (FAO, 2021). The major producers of grape are Italy, France, Spain, USA, Turkey, China and Argentina. India is among the first ten countries in the world in the production of grape. This crop occupies fifth position amongst fruit crops in India. In India, production is 3.7 million tonnes on an area of 148 thousand hectares (NHB, 2022). Grapes are produced in tropical regions (Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu), subtropical regions (Punjab, Rajasthan, Haryana and western areas of Uttar Pradesh) and temperate regions (Himachal Pradesh and UT of Jammu and Kashmir). The largest producer of grapes in India is Maharashtra. China leads the world table grape production followed by India and Turkey ranking 2nd and 3rd.

In Jammu and Kashmir, grape is grown on an area of 318ha with a production of 1734MT. Out of which Kashmir occupies an area of 232ha contributing 1615 MT to production. In Kashmir valley, grape is mainly confined to Repora area of district Ganderbal that occupies an area of about 202 ha with a production of about 1285 MT (Anonymous, 2022). This production of grapes is very low than other states of India. The most common reasons being faulty maintenance of budload, inadequate soil and foliar application of nutrients to the vines. Pruning the vines for optimum cropping according to the vigour is the most reliable method to maintain balance between growth and production. The vine should carry moderate number of canes in order to maintain the uniform vigour throughout its life span. So, canopy, vigour and productivity can be balanced through pruning levels. Eynard and Gay (1992) suggested that equilibrium of crop load versus vegetative development is important for production of quality fruits. Grapes being a deep rooted crop remove a significant amount of nutrients from the soil and depend on adequate nutrient management to account for what is lost. Grapevine nutrition has been a major focus for increasing grapes quality, productivity, and the way of minimizing the gap between actual and potential grape yield. Globally, fertilizers with different NPK ratios and micronutrients are used to achieve a better yield and desirable quality of grapes. Therefore, present study was undertaken to evaluate the interaction of different bud loads, fertilizer and micro nutrient doses on vegetative and pomological traits of grapes.

MATERIALS AND METHODS

The study was carried out during two successive years (2018 and 2019) at Kralbagh, Tehsil Lar, district Ganderbal. Lar is situated between 34.262° North latitude and 74.765 ° East longitude at an average elevation of 1650m (5410 ft) above mean sea level approximately. The study was conducted on 23-year old vines planted at a distance of 14 x15 ft and trained on a bower system. The treatment consisted of 27 combinations constituted by combining 3-levels of fertilizer doses (F₁=FYM 50 kg/vine + Recommended dose of NPK: 555, 227, 470g/vine, F₂=FYM 50 kg/vine+ 2 times recommended dose of NPK: 1110, 454, 940g/vine, F₃=FYM 50 kg/vine+ 3 times recommended dose of NPK: 1665, 681, 1410g/vine) replicated thrice with a double plot size in a completely randomized block design. The observation with respect to leaf area was calculated with the help of leaf area meter (Licor model, 3100) and expressed in centimeter square (cm²). Number of leaves in the randomly selected four canes in different directions were counted and then mean number of leaves per shoot was worked out. Fifty berries were separated from five randomly selected bunches per replication (10 berries per bunch) and weighed on laboratory balance. The mean weight per berry was calculated in grams. Ten berries were taken randomly from each bunch and the berry length was noted in centimeters with a vernier caliper and from this the average berry length was calculated. Freshly extracted juice of fifty randomly selected berries was strained through muslin cloth. It was thoroughly stirred and a drop of it was placed on the hand refractometer and the TSS reading was recorded in °Brix. The readings were corrected at 20°C with the help of temperature correction chart (AOAC, 1990). Total sugars were estimated by Lane and Eynon method (Ranganna, 1986). The count of normal and shot berries per bunch was taken separately. The berries of the size of black pepper or small were considered as shot berries. The sum of the normal berries and shot berries gave the total number of berries per bunch. The percentage of shot berries was calculated according to the procedure suggested by Dhillon *et al.*,

(1992). The data generated were subjected to statistical analysis as per the procedures described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Data presented in Tables 1 & 2 clearly show that there were significant differences among the investigated treatment combinations in relation to leaf area, number of leaves, berry weight, berry length, TSS, total sugars, and incidence of shot berries during both years of study.

Table 1: Combined effect of budload, fertilizer and micronutrients on vegetative and physical characteristics of grape cv. Sahebi

Treatments	Leaf area (cm ²)		No of leaves/Shoot		Berry wt (g)		Berry length (cm)	
	1 st year	2 nd year	1 st Year	2 nd year	1 st year	2 nd year	1 st year	2 nd year
B ₁ M ₁ F ₁	196.70	203.39	46.52	54.81	8.12	8.50	2.80	2.98
B ₁ M ₂ F ₁	194.81	200.17	44.41	53.64	7.83	8.42	2.77	2.96
B ₁ M ₃ F ₁	198.67	207.47	43.62	51.57	7.72	8.35	2.74	2.93
B ₂ M ₁ F ₁	173.62	178.80	65.42	71.35	9.64	9.80	3.13	3.28
B ₂ M ₂ F ₁	171.26	176.92	64.21	69.24	9.36	9.72	3.07	3.25
B ₂ M ₃ F ₁	176.91	180.27	64.00	68.81	9.20	9.56	3.00	3.21
B ₃ M ₁ F ₁	155.63	157.17	55.37	63.42	6.86	7.12	2.49	2.70
B ₃ M ₂ F ₁	147.25	150.28	53.48	61.56	6.72	6.94	2.45	2.68
B ₃ M ₃ F ₁	157.70	159.32	52.76	60.47	6.65	6.86	2.41	2.66
B ₁ M ₁ F ₂	202.91	212.83	42.51	50.92	8.60	9.06	2.90	3.09
B ₁ M ₂ F ₂	200.52	209.95	40.84	49.47	8.41	8.73	2.87	3.06
B ₁ M ₃ F ₂	205.65	215.71	40.36	49.21	8.26	8.62	2.83	3.00
B ₂ M ₁ F ₂	181.67	185.37	62.59	68.95	10.33	10.47	3.27	3.36
B ₂ M ₂ F ₂	179.80	183.52	60.47	67.82	10.24	10.28	3.23	3.34
B ₂ M ₃ F ₂	184.21	187.91	59.68	66.91	9.82	10.00	3.17	3.30
B ₃ M ₁ F ₂	161.81	163.59	52.20	60.12	7.00	7.72	2.61	2.77
B ₃ M ₂ F ₂	160.47	161.47	51.56	59.84	7.00	7.51	2.57	2.75
B ₃ M ₃ F ₂	163.92	165.77	50.89	58.76	6.91	7.40	2.54	2.73
B ₁ M ₁ F ₃	209.27	219.37	38.67	48.75	9.00	9.38	3.00	3.18
B ₁ M ₂ F ₃	207.81	217.65	37.94	47.64	8.92	9.30	2.98	3.15
B ₁ M ₃ F ₃	213.12	221.56	37.71	46.01	8.76	9.26	2.95	3.12
B ₂ M ₁ F ₃	188.52	195.35	59.13	66.72	10.73	10.95	3.36	3.48
B ₂ M ₂ F ₃	186.43	191.72	57.90	65.58	10.69	10.82	3.33	3.45
B ₂ M ₃ F ₃	190.74	197.27	56.26	64.27	10.40	10.64	3.29	3.43
B ₃ M ₁ F ₃	167.61	171.62	49.62	56.82	7.64	8.28	2.70	2.88
B ₃ M ₂ F ₃	165.80	169.81	47.85	56.41	7.42	8.06	2.67	2.85
B ₃ M ₃ F ₃	169.37	175.47	47.43	55.83	7.28	7.96	2.65	2.81
CD _(0.05)	2.98	2.77	0.67	0.72	0.41	0.5	0.1	0.27

The combination B₁F₃M₃ recorded maximum leaf area (213.12 and 221.56 cm²) during the two years, respectively (Table 1). This may be because of the fact that this treatment combination resulted in stronger leaves that are found in areas of canopy with low budload and relatively high light levels.

Table 2: Combined effect of budload, fertilizer and micronutrients on chemical characteristics and incidence of shot berry in grape cv. Sahebi

Treatments	TSS (^o Brix)		Total sugars (%)		Shot berry (%)	
	1 st year	2 nd year	1 st year	2 nd year	1 st year	2 nd year
B ₁ M ₁ F ₁	16.38	17.65	12.67	13	13.82	12.86
B ₁ M ₂ F ₁	16.17	17.26	12.47	12.51	13.12	13.62
B ₁ M ₃ F ₁	16.21	17.42	12.64	12.74	13.00	13.33
B ₂ M ₁ F ₁	18.00	19.12	15.18	15.62	9.76	9.58
B ₂ M ₂ F ₁	17.69	18.86	14.54	15.2	11.21	10.26
B ₂ M ₃ F ₁	17.87	19.00	14.77	15.35	10.54	9.92
B ₃ M ₁ F ₁	15.07	15.74	10.87	11.24	17.62	17.43
B ₃ M ₂ F ₁	14.63	15.18	10.52	10.94	19.58	18.28
B ₃ M ₃ F ₁	14.88	15.46	10.64	11.16	19.12	17.76
B ₁ M ₁ F ₂	16.92	18.22	13.45	13.84	13.51	11.96
B ₁ M ₂ F ₂	16.47	17.88	12.94	13.32	13.27	12.52
B ₁ M ₃ F ₂	16.64	18.07	13.18	13.67	13.90	12.35
B ₂ M ₁ F ₂	18.46	19.56	15.82	16.41	8.66	8.41
B ₂ M ₂ F ₂	18.20	19.25	15.37	15.88	9.24	9.14
B ₂ M ₃ F ₂	18.31	19.47	15.64	16.35	8.83	8.72
B ₃ M ₁ F ₂	15.52	16.58	11.39	11.85	16.43	15.94
B ₃ M ₂ F ₂	15.18	16.15	11.00	11.58	17.37	16.89
B ₃ M ₃ F ₂	15.36	16.32	11.18	11.71	16.77	16.22
B ₁ M ₁ F ₃	16.00	17.00	12.25	12.25	15.26	14.15
B ₁ M ₂ F ₃	15.61	16.77	11.65	12.00	16.17	15.41
B ₁ M ₃ F ₃	15.87	16.92	12.08	12.12	15.70	19.84
B ₂ M ₁ F ₃	17.38	18.67	14.28	14.75	11.64	10.82
B ₂ M ₂ F ₃	17.00	18.36	13.97	14.12	12.31	11.75
B ₂ M ₃ F ₃	17.27	18.51	14.00	14.53	12.00	11.37
B ₃ M ₁ F ₃	14.57	14.82	10.31	10.71	20.28	18.85
B ₃ M ₂ F ₃	14.26	14.38	10.14	10.32	21.96	19.75
B ₃ M ₃ F ₃	14.48	14.64	10.22	10.56	20.64	19.36
CD _(0.05)	0.1	0.12	0.16	0.23	0.15	0.27

This is in accordance with the findings of Cangi and Kilic (2011) and Shalan (2013). Also, there is a significant role of nitrogen as a constituent of amino acids and protein and phosphorus and potassium in encouraging cell division and development of meristematic tissues (Tisdale *et al.*, 1985). These findings are in agreement with Delgado *et al.* (2004) and Salem *et al.* (2004). Further boron plays an important role in plant tissue growth and protein synthesis. Zinc increases the surface area of leaves by activating enzymes responsible for generating chlorophyll. The results are in agreement with the reports of Mostafa *et al.* (2006) and Al Iman and Al Saidi (2007).

The number of leaves was highest in B₂F₁M₁ (65.42 and 71.35) during the two years respectively (Table-1). Interaction B₂F₁M₁ recorded highest number of leaves 65.42 and 71.35 during the two years respectively. This may be due to the fact that as bud load increases internodal length decreases which in turn affect the number of leaves/shoot in this treatment combination. The data is in accordance with the findings of Coban and Kara (2002) and Shalan (2013). Also shoots under the low and medium fertilizer dose grow less rapidly with shorter internodes which in turn affected the number of leaves per shoot. Similar results were found by Keller *et al.* (1999) and Salem *et al.* (2004). Furthermore, boron increased the number of leaves/shoot due to its effect on nitrogen metabolism. This is in conformity with the findings of Zhang (1989) and Ahmad and Abd El-Hameed (2003).

Maximum berry weight was recorded in B₂F₃M₁ (10.73 and 10.95g) which was non significantly followed by B₂F₃M₂ (10.69 and 10.82g), B₂F₃M₃ (10.40 and 10.64g) and B₂F₂M₁ (10.33 and 10.47g) during the two years, respectively (Table 1). This increased berry weight might be due to better accumulation of photosynthesis, better uptake of nutrients and improved micronutrient status in this treatment combination. This is in line with the findings of Ali (2000), Mostafa *et al.*, (2006), Fawzi *et al.*, (2010) and Abd El-Razek *et al.*, (2011). The interaction B₂F₃M₁ recorded maximum berry length (3.36 and 3.48cm) followed non-significantly by B₂F₃M₂ (3.33 and 3.45 cm), B₂F₃M₃ (3.29 and 3.43cm) and B₂F₂M₁ (3.27 and 3.36cm) during the two years respectively (Table 1). This may be because of optimum light and fruit load in this interaction treatment as a result of which the available assimilates reached the individual fruit in adequate quality. Our results are in line with the findings of Rather (2006) and El-Kady *et al.* (2010). Furthermore, the increased berry length is also due to the role of nitrogen, phosphorus, potassium and boron in enhancing the cell division and cell elongation. This is in agreement with the findings of Ali (2000), Delgado *et al.* (2004), Mostafa *et al.* (2006) and Abd El-Razek *et al.* (2011).

Maximum TSS was noticed in the interaction B₂F₂M₁ (18.46 and 19.56⁰Brix) during the two years respectively and in 2nd year, it was non significantly followed by B₂F₂M₃ (19.47⁰Brix) - Table-2. This may be because of optimum leaf number and higher carbohydrate assimilation in this interaction treatment. These results are in accordance with Arora and Gill (2009) and Fawzi *et al.* (2010). This may be also due to the fact that nitrogen, phosphorus and potassium increases the availability of the assimilates, improves accumulation and transport of sugars in the berries which in turn induces high TSS. These findings are in parallel with those of Martin *et al.* (2004) and Abd-EL Razek *et al.* (2011). Further boron plays an important role in nucleic acid synthesis, nutrient uptake, translocation of sugars and nutrients from leaves to fruit. These results are in agreement with the findings of Prabu and Singaram (2001) and Usha and Singh (2002).

The maximum percentage of total sugars (15.82 and 16.41%) was attained with B₂F₂M₁ interaction during the two years respectively whereas in 2nd year it was followed non significantly by the interaction B₂F₂M₃ (16.35%) interaction (Table-2). This may be due to maximum photosynthates produced in this treatment combination. These results are in line with the results obtained by Fawzi *et al.* (2010). This may be also because of adequate application of nitrogen, phosphorus and potassium resulting in better sugar accumulation in berries. These results are in line with those of Martin *et al.* (2004) and Abd-EL Razek *et al.* (2011). Further boron helps in better translocation of sugars and nutrients from leaves to fruit. These findings are in parallel with the reports of Shah (2004) and Mostafa *et al.* (2006). Minimum percentage of shot berry was recorded in B₂F₂M₁ (8.66 and 8.41%) during the two years respectively (Table-2). This may be due to optimum photosynthesis and proper C/N ratio maintained in this treatment combination. This is in accordance with the results of Gill and Sharma (2005). Further boron helps in better pollination,

germination and fertilization of ovules that might have resulted in decreasing the incidence of shot berry. These results are in conformity with the Farooq and Hulmani (2000) and Shah (2004).

CONCLUSION

Thus it can be concluded from the present investigation that the combined effect of budload (B_2), micronutrient (M_1) and fertilizer dose (F_2) significantly improved the vegetative and pomological traits of grape cv. Sahebi

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