Influence of bud load and micronutrients on pomological traits and economics of grape cv. Sahebi

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ABSTRACT

The studies on the influence of bud load and micronutrients on pomological traits and economics of grape cv. 'Sahebi' was carried out in model grapevine orchard of department of Horticulture at Kralbagh, Tehsil Lar Distt. Ganderbal (J&K) for two consecutive years. The treatment consisted of 3 levels of budload B_1 (96 buds/vine), B_2 (128 buds/ vine) and B_3 (160 buds/vine), 3 levels of micronutrients viz. M_1 (Solubor 0.1%), M_2 ($ZnSO_4$ 0.4%) and M_3 (Solubor 0.1% + $ZnSO_4$ 0.4%) applied two weeks before bloom and their combinations replicated thrice with a double plot size in a completely randomized block design..Among the treatments, Budload B_2 (128 buds/vine) and micronutrient M_1 (Solubor 0.1%), recorded maximum number of leaves/shoot, fruit yield, bunch weight, berry weight, juice content, Total soluble solids, total sugars, anthocyanin content, benefit- cost ratio and minimum acidity during both the years of study. B_2M_1 interaction resulted in maximum number of leaves/shoot, fruit yield, bunch weight, berry weight, juice content, TSS, total sugars, anthocyanin content, benefit- cost ratio during both years. It is concluded that budload B_2 (128 buds/vine), M_1 (Solubor 0.1%) and their combination is the best for improving pomological traits and benefit-cost ratio of grape cv. Sahebi.

Keywords – budload, grape, micronutrients, sahebi, yield

I.INTRODUCTION

Grape (*Vitis vinifera* L.) is one of the most important fruit crops of temperate zone, which has acclimatized to sub tropical and tropical agro climatic conditions prevailing in the Indian sub-continent. It is a refreshing fruit, rich in sugars, acids, minerals, vitamins and tannins. It can be eaten raw or can be used for making jam, juice, jelly, vinegar, wine, grape seed extracts, raisins, molasses and grape seed oil. In India, the major grape growing states are Maharashtra, Karnataka, Andhra Pradesh, Punjab and Tamil Nadu and the bulk of the production is used for table purpose followed by raisin. In Jammu and Kashmir, grapes are grown in an area of 321 hectares with a production of 648 MT (Anonymous,[1]) but the productivity of grape vines had been declining and has come down to a very low level. Further quality of grape is also poor when compared to other grape growing states of India. The possible reason is non-adoption of proper management practices particularly pruning and fertilizer application. The productivity and quality of grapes is dependent mainly on perfect pruning and proper fertilization. Proper pruning plays an important role in sustaining the productivity for longer period of time. The purpose of pruning is to regulate or encourage good yield and to improve size and quality of fruit. Micro-nutrients e.g. B and Zn are those essential nutrient elements which are required in very small quantity but they have specific structural physiological and metabolic roles in the plant system. Boron is an important micro-nutrient governing many physiological and biochemical plant processes. It plays a significant role in flowering, fruit set, nitrogen metabolism, hormone movement and its action, sugar transport, cell wall synthesis and lignifications. Besides regulating K/Ca ratio in plants, it is associated with Ca uptake and also increases permeability of the membrane. Foliar application of boron act as a signal capable of interacting with cellular transcription factors to regulate various physiological processes affected by boron deficiency. Zinc is an important nutrient element for growth, flowering and quality of fruits. It is involved in the biosynthesis of the plant hormone, indole acetic acid and it is a component of variety of enzymes such as carbonic anhydrase, alcohol dehydrogenase. Zinc also plays a role in nucleic acid and protein synthesis and helps in the utilization of phosphorus and nitrogen. If major macro and micro-nutrients are not replenished regularly, they start depleting in the soil and reach a threshold where they become deficient and result in reduced plant growth, yield and fruit quality. For a successful commercial cultivation of fruits, it is essential to ensure vigorous vegetative growth and development during the entire productive life of the tree. Therefore, it is necessary to apply the nutrients through manures and fertilizers to meet the growth and reproductive needs of the grapevine. Further the optimum combination of the pruning severity and the fertilizer rate play an important part in regulating the tree performance.

The main grape growing belt of Kashmir valley is district Ganderbal and Sahebi is the predominating variety of the area but grape vines in the area are not being maintained on the scientific lines with respect to pruning, application of nutrients and other cultural techniques thus resulting in low yields of poor quality berries. Hence the present investigations were carried out to standardize the bud load and micronutrients for optimum yield and quality of grape cv. Sahebi.

II.MATERIALS AND METHODS

These investigations were carried out to assess the influence of bud load, micronutrients and their combinations on pomological traits and economics of grape cv. 'Sahebi' in model grapevine orchard of department of Horticulture at Kralbagh, Tehsil Lar District Ganderbal (J&K) for two consecutive years. The treatment consisted of 3 levels of budload (B_1-96 buds/vine, B_2 -128 buds/ vine and B_3-160 buds/vine), 3 levels of micronutrients viz. M_1 (Solubor 0.1%), M_2 ($ZnSO_4$ 0.4%) and M_3 (Solubor 0.1% + $ZnSO_4$ 0.4%) applied two weeks before bloom and their combinations replicated thrice with a double plot size in a completely randomized block design. 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. Fruit yield per vine was calculated based on the number of bunches and the mean weight of bunches at harvest as suggested by (Khanduja and Balasubramanyam, [2]). The weight of five bunches from each replication was observed on laboratory balance and the mean weight per bunch was recorded in grams. 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. Fruit juice percentage was measured as per the method described by (Mazumdar and Majumder , [3]).

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 ^{o}Brix. The readings were corrected at 20^{o}C with the help of temperature correction chart (A.O.A.C., [4]). Titrable acidity was estimated by titrating a known quantity of homogenised juice against 0.1N NaOH solution using phenolphthalein as indicator (A.O.A.C., [4]) and was expressed in terms of tartaric acid. Total sugars were estimated by Lane and Eynon method (Ranganna, [5]). Anthocyanin content was extracted with ethanolic hydrochloride and the intensity of the colour appeared was measured colorimetrically (Kaur and Dhillon, [6]). Economics was calculated in terms of benefit cost ratio which was determined taking into account cost benefit parameters. The total cost of cultivation was calculated by taking into consideration, total basic cost per hectare (which included recurring and non-recurring cost) and treatment cost per hectare. Net income was calculated by deducting cost of cultivation per hectare from the gross income per hectare.The data generated were subjected to statistical analysis as per the procedures described by (Gomez and Gomez [7]).

III.RESULTS AND DISCUSSION

Bud load, micronutrients and their interactions appreciably influenced number of leaves/shoot, fruit yield, bunch weight, berry weight, juice content, (Table 1). Highest number of leaves per shoot was recorded with budload B_2 (61.07 and 67.74), micronutrient M_1 (52.45 and 60.21) and combination B_2M_1 (62.38 and 69.01) in comparison to other bud load and fertilizer doses during both the years, respectively. Increased number of leaves per shoot might be due to optimum bud load and nutrient supply under these treatments. The results are in conformity with the findings of (Shalan, [8]) and (Salem *et al,* [9]). Maximum number of leaves/shoot obtained in micronutrient M_1 (Solubor-0.1%) is due to the favourable effect of boron on metabolism of nitrogen which in turn increased the number of leaves/shoot. This is in agreement with the findings of (Zhang, [10]) and (Ahmad and Abd El-Hameed , [11]).

Highest fruit yield per vine (21.73 and 25.23 kg/vine) was recorded in vines pruned to B_2 and micronutrient M_1 (19.78 and 22.81kg/vine). Combination of B_2M_1 registered maximum fruit yield (22.20 and 25.93 kg/vine) in comparison to other bud load and micronutrient doses during both the years, respectively. This may be due to increase in both number of clusters per vine and cluster weight and better flower set, improved pollen viability, germination and fertilization, reduced fruit drop and increase in the berry size. These results are in agreement with the findings of (Prabu and Singaram, [12]) and (Fawzi *et al,* [13]).

Among bud load treatments, highest bunch weight (451.52 and 468.64 g) was recorded with budload B_2. Among micronutrients, highest bunch weight (402.81 and 427.54 g) was recorded with M_1. Combination of B_2M_1 resulted in highest bunch weight (455.49 and 475.52 g) during both the years under study. The increase in bunch weight may be due to more number of leaves which might have resulted in better photosynthesis and optimum supply and uptake of nutrients under these treatments. These results agreed with the findings of (Fawzi *et al.* [13])and (Abd El-Razek *et al,* [14]). The highest bunch weight observed with the application of the micronutrient M_1 (Solubor-0.1%) was as a result of more fruitset due to boron. These results are in agreement with the findings of (Usha and Singh, [15]) and (Mostafa *et al,* [16]).

Highest berry weight (10.05 and 10.25g) was recorded with budload B_2. Among micronutrients, highest berry weight (8.66 and 9.03 g) was recorded with M_1. Maximum berry weight (10.23 and 10.41g) was observed in combination B_2M_1 during both the years of study. The increase in berry weight may be due to higher bunch weight and size as a result of better photosynthesis and optimum supply and uptake of nutrients under these treatments. The results are inconformity with the findings of (Fawzi *et al.* [13]) and (Abd El-Razek *et al,* [14]). Maximum berry weight was recorded in vines treated with micronutrient M_1 (Solubor-0.1%). The positive action of micronutrient M_1 (Solubor-0.1%) on berry weight might be attributed due to the improved vine nutritional status by boron. The results are in harmony with those obtained by (Usha and Singh, [15]) and (Mostafa *et al,* [16]).

Highest fruit juice (69.91 and 72.15 %) was recorded with budload B_2. Among micronutrients, highest fruit juice (67.36 and 68.89 %) was recorded with M_1. Maximum juice content (70.19 and 72.52%) was noticed in B_2M_1 combination during both the years under study. Higher berry juice in the present investigation may be due to maximum higher berry weight with these treatments. Similar observation has been recorded by (Gill and Sharma, [17]. Micronutrient M_1 (Solubor-0.1%) increased the juice percentage significantly which may be attributed to increased berry size due to boron. Similar results were also reported by (Prabu and Singaram, [12]) and (Shah, [18]).

Data on response of budload, micronutrients and their interaction on berry TSS, titrable acidity, total sugars and anthocyanin conent, and benefit cost ratio is presented in Table 2. Maximum TSS (17.80 and 18.98 ^{o}Brix), total sugars (14.84 and 15.36 %) and lowest acidity (0.444 and 0.466%) were recorded with budload B_2. Among micronutrients, highest TSS (16.48 and 17.48 ^{o}Brix), total sugars (12.92 and 13.30 %) and lowest titrable acidity (0.488 and 0.505%) were recorded with M_1. Combination of B_2M_1 interaction resulted in highest TSS (17.95 and 19.12 ^{o}Brix), total sugars (15.09 and 15.59 %). This may be due to enhanced photosynthates production, more hydrolysis of polysaccharides into monosaccharides and increased catabolization of organic acids into sugars. These findings are in parallel with those of (Fawzi *et al.* [13]) and (Abd El-Razek *et al,* [14])..However,the combined influence of budload and micronutrients showed no significant effect on acidity during the two years.

Budload B_2 resulted in significantly higher anthocyanin content in berries (65.47 and 68.94 mg/100 g). Among micronutrients, M_1 resulted in more anthocyanin accumulation (59.36 and 61.20 mg/100 g). The highest anthocyanin content (66.42 and 69.77mg/100g) was found with B_2M_1 combination during the 2 years.The increase in anthocyanin content with these treatments may be due to better light penetration and more translocation of metabolites to the berries in vines with moderate budload and stimulation of the activity of phenylalanine ammonia lyase enzyme which is involved in anthocyanin synthesis. The results are inconformity with the findings of (Mahfouz [19] and (Singh [20]). Micronutrient M_1 (Solubor-0.1%) had a most significant effect on anthocyanin content as boron plays an important role in metabolism of phenolic compounds resulting into the promotion of red colour in the fruits. These results are in agreement with those of (Bhat *et al*, [21])and (Ganai [22]).

Benefit cost ratio was highest with budload B_2 (2.87 and 3.17), micronutrient M_1 (2.58 and 2.85) and B_2M_1combination (2.94 and 3.28)) in comparison to other treatment combinations during both the years.

IV. TABLES

Table 1. Effect of bud load, micronutients and their combinations on fruit yield and fruit physical characteristics of grape cv. Sahebi.

Treatments	Number of leaves per shoot		Fruit yield (Kg/vine)		Bunch weight (g)		Berry weight (g)		Juice %	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
B1	41.40	50.23	16.76	19.50	390.27	426.85	8.40	8.84	67.12	68.59
B2	61.07	67.74	21.73	25.23	451.52	468.64	10.05	10.25	69.91	72.15
B3	51.24	59.25	19.25	21.82	352.25	370.55	7.05	7.53	63.80	64.70
$CD_{(0.05)}$	0.53	0.62	1.45	1.62	20.13	15.53	0.17	0.19	1.32	1.37
M_1	52.45	60.21	19.78	22.81	402.81	427.54	8.66	9.03	67.36	68.89
M_2	50.96	59.02	18.73	21.60	393.64	417.20	8.51	8.86	66.99	68.50
M_3	50.30	57.98	19.23	22.14	397.59	421.30	8.33	8.73	66.49	68.04
$CD_{(0.05)}$	0.20	0.23	0.15	0.17	3.22	4.12	0.01	0.02	0.15	1.29
B_1M_1	42.57	51.49	17.27	20.11	396.50	431.70	8.57	8.98	67.47	68.99
B_1M_2	41.06	50.25	16.22	18.92	385.21	422.16	8.39	8.82	67.11	68.54
B_1M_3	40.56	48.93	16.79	19.46	389.09	426.70	8.25	8.74	66.79	68.23
B_2M_1	62.38	69.01	22.20	25.93	455.49	475.52	10.23	10.41	70.19	72.52
B_2M_2	60.86	67.55	21.29	24.45	447.26	461.57	10.10	10.27	69.87	72.13
B_2M_3	59.98	66.66	21.69	25.30	451.81	468.85	9.81	10.07	69.67	71.80
B_3M_1	52.40	60.12	19.87	22.38	356.43	375.41	7.17	7.71	64.41	65.16
B_3M_2	50.96	59.27	18.68	21.43	348.44	367.87	7.05	7.50	63.99	64.84
B_3M_3	50.36	58.35	19.22	21.64	351.88	368.36	6.95	7.39	63.02	64.10
$CD_{(0.05)}$	0.55	0.67	1.48	1.68	22.05	16.23	0.21	0.20	1.35	1.39

Table 2. Effect of bud load, micronutrients and their combinations on fruit chemical characteristics and benefit: cost ratio of grape cv. Sahebi**.**

Treatments	TSS (^{o}Brix)		Titrable acidity (%)		Total sugars (%)		Anthocyanin (mg/100 g)		Benefit : cost ratio	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
B1	16.25	17.47	0.500	0.507	12.60	12.83	58.43	60.04	2.14	2.42
B2	17.80	18.98	0.444	0.466	14.84	15.36	65.47	68.94	2.87	3.17
B3	14.88	15.47	0.551	0.562	10.70	11.12	51.14	51.34	2.47	2.67
$CD_{(0.05)}$	0.45	0.53	0.04	0.03	1.75	1.67	1.12	1.15	-	-
M_1	16.48	17.48	0.488	0.505	12.92	13.30	59.36	61.20	2.58	2.85
M_2	16.13	17.12	0.503	0.524	12.51	12.87	57.36	59.24	2.41	2.67
M_3	16.32	17.31	0.497	0.506	12.71	13.13	58.30	59.87	2.49	2.74
$CD_{(0.05)}$	0.10	0.12	NS	NS	0.31	0.28	1.04	1.26	-	-
B_1M_1	16.43	17.62	0.486	0.500	12.82	13.03	59.60	61.18	2.23	2.52
B_1M_2	16.08	17.30	0.500	0.520	12.35	12.61	57.47	58.93	2.05	2.33
B_1M_3	16.24	17.47	0.496	0.503	12.63	12.84	58.20	60.00	2.14	2.42
B_2M_1	17.95	19.12	0.433	0.460	15.09	15.59	66.42	69.77	2.94	3.28
B_2M_2	17.63	18.82	0.460	0.476	14.63	15.07	64.67	68.30	2.80	3.06
B_2M_3	17.82	18.99	0.440	0.460	14.80	15.41	65.33	68.75	2.86	3.18
B_3M_1	15.05	15.71	0.546	0.556	10.86	11.27	52.08	52.65	2.57	2.75
B_3M_2	14.69	15.24	0.550	0.576	10.55	10.95	49.95	50.50	2.39	2.62
B_3M_3	14.91	15.47	0.556	0.553	10.68	11.14	51.39	50.86	2.46	2.64
$CD_{(0.05)}$	0.48	0.55	NS	NS	0.34	0.30	1.25	1.28	-	-

V. CONCLUSION

From the present study, it is concluded that budload B_2 (128 buds/vine) micronutrient M_1 (Solubor 0.1%) and their combination is the best for improving physico – chemical attributes of grape cv. Sahebi with highest benefit : cost ratio.

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