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Original Research Article

Effect of Fertilizers and Micronutrients on Physico-Chemical Aspects and Economics of Grapes Cv. Sahebi

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A B S T R A C T

The experiment was conducted in model grapevine orchard of department of Horticulture at Kralbagh, Tehsil Lar, Ganderbal on 23-year old vines trained on bower system so as to assess the effect of macro and micro-nutrients on various berry related parameters and also on the benefit : cost ratio of grapes cv. Sahebi. The vines were planted at a distance of 14ft x15ft. The treatment consisted of 3-levels of fertilizer doses (F_1=FYM 50 kg/vine + Recommended dose of NPK: 555, 227, 470g/vine, F_2=FYM 50 kg/vine+ 2 times recommended dose of NPK: 1110, 454, 940g/vine, F_3=FYM 50 kg/vine+ 3 times recommended dose of NPK: 1665, 681, 1410g/vine) and their combinations replicated thrice with a double plot size in a completely randomized block design. Results revealed that fertilizer level, F_2 (FYM-50 kg/vine + 2 times recommended dose-NPK: 1110, 454, 940 g/vine) recorded highest number of bunches, juice content, TSS/acid ratio and benefit- cost ratio during both the years. Maximum number of bunches, juice content, TSS/acid ratio, ascorbic acid and benefit- cost ratio was observed in micronutrient M_1(Solubar-0.1%) during the two years. Maximum number of bunches and TSS/acid ratio were recorded in the interaction M_1F_2 during both the years. Main effect of fertilizers showed no significant effect on ascorbic acid whereas micronutrients exerted a significant influence on ascorbic acid during the two years. Highest value of ascorbic acid was recorded in vines treated with micronutrient, M_3. The highest ascorbic acid was recorded in M_3F_3 combination in both the years. Fertilizer dose at moderate level, F_2 resulted in maximum benefit cost ratio and fertilizer dose at highest level, F_3 resulted in minimum benefit cost ratio during the two years respectively. The interaction effect of micronutrient and fertilizer dose (M_1F_2) had shown highest benefit cost ratio of in two years respectively. However the main effect as well as interaction effect of fertilizer dose and micronutrients had no significant influence on berry L/D ratio and also on number of seeds/berry.

Keywords

Nutrient, seed number, ascorbic acid and B:C ratio

Introduction

Grape (*Vitis vinifera* L.) is one of the most popular and delicious fruits, and rich source of vitamins and minerals. A grape is a non-climacteric fruit, in particular a berry, that grows on the perennial and deciduous woody vines of the genus *Vitis*. According to the Food and Agriculture Organization (FAO), 75,866 square kilometers of the world are dedicated to grapes. Approximately 71% of world grape production is used for wine, 27%

as fresh fruit, and 2% as dried fruit. In India grapes are cultivated in an area of 140 thousand ha with a total production of 3041 thousand tons and productivity of 21.72 tons/ ha (Anonymous, 2019). Major grape growing states are Maharashtra, Karnataka, Andhra Pradesh, Punjab and Tamil Nadu. Maharashtra ranks first in production producing 62.7% of the total production of grapes. In Jammu and Kashmir, grapes are grown in an area of 332 hectares with a production of 1048 MT (Anonymous, 2018-19) 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 fertilizer and micronutrient application. The supply of the mineral nutrients affects vine development, physiology and berry quality. Also, grape is a heavy feeder of nutrients. Three of the major elements i.e. N, P, K are removed from the soil in large amounts. Deficiency of nutrients causes poor growth, yield and quality of fruits (Kumar *et al.*, 2015 and Mishra *et al.*, 2016). So there is a need to achieve higher production and productivity of grape by means of maintenance of proper nutrient dose and micronutrient management and thereby providing a package to the farmers for attaining high production and quality. Keeping all these aspects in mind, the present investigation was undertaken to assess the effect of fertilizers and micronutrients on the physico-chemical parameters (No. of bunches /vine, L/D ratio, Number of seeds/ berry, juice content, TSS/ Acid ratio and ascorbic acid) and benefit: cost ratio of grape berry.

Materials and Methods

The experiment was conducted in model grapevine orchard of department of Horticulture at Kralbagh, Tehsil Lar, Ganderbal. Lar is located between 34.262^{o} North latitude and 74.765^{o} East longitude at an average elevation of 1650m (5410 ft) above mean sea level approximately. The study was conducted on 23-year old vines trained on bower system. The vines were planted at a distance of 14ft x15ft. The treatment consisted of 3-levels of fertilizer doses (F_1=FYM 50 kg/vine + Recommended dose of NPK: 555, 227, 470g/vine, F_2=FYM 50 kg/vine+ 2 times recommended dose of NPK: 1110, 454, 940g/vine, F_3=FYM 50 kg/vine+ 3 times recommended dose of NPK: 1665, 681, 1410g/vine) and their combinations replicated thrice with a double plot size in a completely randomized block design.

Total number of bunches per vine was counted from each replication and the mean number of bunches per vine was calculated. The average length of a berry was divided by its average diameter to obtain L/D ratio. For calculating seed number, seeds were extracted from 50 randomly selected berries in each replication. The seeds were counted and average number per berry was calculated. For estimating the juice content a known weight of randomly selected berries was macerated using pestle and mortar. The juice was extracted by squeezing through the muslin cloth and its quantity was measured in cylinder (Mazumdar and Majumder, 2003).

The per cent juice content was calculated by dividing the juice yield (ml) by weight of the berries (g). For calculating TSS/acid ratio the total soluble solids and titrable acidity values were estimated (A.O.A.C., 1990). Quantitative determination of ascorbic acid was done by 2, 6-dichlorophenol indophenol visual titration method (Ranganna, 1986). The statistical methods described by Gomez and Gomez (1984) were followed to analyse and interpret the data. The test of significance was made with 5 per cent of significance.

Results and Discussion

The data in Table-1 indicated that the number of bunches/vine was significantly affected by fertilizer and micronutrients. Significantly higher number of bunches/vine (50.90 and 55.01) was observed in fertilizer dose, F_2 (FYM-50 kg/vine + 2 times recommended dose-NPK: 1110, 454, 940 g/vine) and lower number of bunches/vine (46.31 and 50.50) was recorded in fertilizer dose, F_3 (FYM-50 kg/vine + 3 times recommended dose-NPK: 1665, 681, 1410 g/vine) during the two years respectively. Optimum nitrogen and phosphorus is required for bud fertility.

Optimum potassium is important for inflorescence formation; its application is known to convert sterile buds to fertile buds through increased carbohydrate accumulation. This is in accordance with the findings of Girgis *et al.,* (1998) and Abd El-Razek *et al.,* (2011). Maximum number of bunches/vine (49.39 and 53.60) was recorded in micronutrient M_1 (Solubor-0.1%) and minimum was observed in micronutrient, M_2, $ZnSO_4$-0.4% (47.80 and 52.12) during the two years respectively.

Combination of micronutrient and fertilizer also showed significant effect on number of bunches/vine. Highest number of bunches/vine was recorded in the combination of M_1F_2 (51.31) which was statistically at par with M_3F_2 (51.00) and M_2F_2 (50.40) during 1st year and during 2nd year the same combination M_1F_2 recorded highest number of bunches/vine (55.84) which was statistically at par with M_3F_2 (54.81).

The reason for this is due to the role of boron in flower set, pollen viability, germination, fertilization, fruit set and reduced fruit drop (Shah, 2004). This is in conformity with the findings of Mostafa *et al.,* (2006).

The main effect as well as interaction effect of fertilizer dose and micronutrients had no significant influence on berry L/D ratio and also on number of seeds/berry (Table 1).

These results are in line with the findings of Palanichamy *et al.*, (2004) and Nikkah *et al.*, (2013). The perusal of data (Table-1) revealed that fertilizer dose and micronutrients exhibited a significant influence on berry juice per cent. As length/diameter ratio indicates fruit shape which infact is a characteristic genetic feature of a genotype and cannot be easily altered by external factors like budload, fertilizer and micronutrients. Similar results have been reported by Ganai (2006).

Highest juice content (68.18 and 69.63%) was recorded in fertilizer dose, F_3 (FYM-50 kg/vine + 3 times recommended dose-NPK: 1665, 681,1410g/vine) followed non significantly by fertilizer dose, F_2 : FYM(50 kg/vine + 2 times recommended dose-NPK: 1110, 454, 940 g/vine (66.92 and 68.60%) and lowest juice content (65.73 and 67.22%) was observed in fertilizer dose F_1 (FYM-50 kg/vine + Recommended dose-NPK: 555, 227, 470 g/vine) during 1st and 2nd year respectively. Vines treated with micronutrient M_1 (Solubor-0.1%) recorded maximum juice content (67.36 and 68.89%) and micronutrient, M_3 (Solubor-0.1% + $ZnSO_4$-0.4%) registered the minimum juice content (66.49 and 68.04%) during the 1st and 2nd year respectively.

The interaction effect between micronutrient and fertilizer dose recorded non-significant difference on juice content during the course of study. This is because of higher weight of berry recorded in these treatments. This may also be due to increased uptake of water by the nutrients. These results are parallel with the findings of Prabu and Singaram (2001), Shah (2004) and Abd El-Razek (2011).

Table.1 Effect of fertilizer and micronutrient application on number of bunches/vine, L/D ratio, Juice (%) and Seed number in grape cv. Sahebi

Treatments	Number of bunches/vine		L/D ratio		Juice (%)		Seed number	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
F_1	48.59	53.03	1.699	1.815	65.73	67.22	2.36	2.33
F_2	50.90	55.01	1.632	1.753	66.92	68.60	2.62	2.33
F_3	46.31	50.50	1.661	1.751	68.18	69.63	2.66	2.47
CD (p ≤ 0.05)	**1.13**	**1.11**	**NS**	**NS**	**1.27**	**1.29**	**NS**	**NS**
M_1	49.39	53.60	1.656	1.760	67.36	68.89	2.59	2.44
M_2	47.80	52.12	1.666	1.771	66.99	68.50	2.55	2.36
M_3	48.62	52.81	1.669	1.788	66.49	68.04	2.51	2.33
CD (p ≤ 0.05)	**0.15**	**0.12**	**NS**	**NS**	**0.15**	**0.17**	**NS**	**NS**
F_1M_1	49.82	53.55	1.690	1.807	66.30	67.72	2.44	2.33
F_1M_2	47.50	52.60	1.699	1.809	65.89	67.32	2.33	2.33
F_1M_3	48.46	52.93	1.709	1.830	64.99	66.61	2.33	2.33
F_2M_1	51.31	55.84	1.633	1.748	67.22	68.85	2.66	2.33
F_2M_2	50.40	54.37	1.636	1.751	66.91	68.65	2.66	2.33
F_2M_3	51.00	54.81	1.607	1.761	66.65	68.29	2.55	2.33
F_3M_1	47.03	51.42	1.647	1.727	68.55	70.10	2.66	2.66
F_3M_2	45.50	49.38	1.664	1.753	68.17	69.54	2.66	2.44
F_3M_3	46.40	50.68	1.674	1.775	67.83	69.23	2.66	2.33
CD (p ≤ 0.05)	**1.17**	**1.19**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table.2 Effect of fertilizer and micronutrient application on TSS/ acid ratio, ascorbic acid content and B/C ratio in grape cv. Sahebi

Treatments	TSS /Acid ratio		Ascorbic acid (mg/100g)		B/C ratio	
	1st year	2nd year	1st year	2nd year	1st year	2nd year
F_1	33.35	34.52	7.54	7.90	2.48	2.74
F_2	35.60	36.46	7.83	8.27	2.61	2.88
F_3	31.18	32.39	8.24	8.64	2.39	2.64
CD (p ≤ 0.05)	**2.09**	**2.03**	**NS**	**NS**		
M_1	34.30	35.13	7.87	8.30	2.58	2.85
M_2	32.44	33.36	7.76	815	2.41	2.67
M_3	33.40	34.87	7.98	8.37	2.49	2.74
CD (p ≤ 0.05)	**1.00**	**0.94**	**0.12**	**0.14**		
F_1M_1	34.14	35.11	7.53	7.95	2.59	2.82
F_1M_2	32.80	33.67	7.48	7.75	2.39	2.69
F_1M_3	33.12	34.76	7.60	8.01	2.47	2.73
F_2M_1	36.77	37.37	7.83	8.32	2.67	2.99
F_2M_2	34.12	35.15	7.72	8.12	2.56	2.80
F_2M_3	35.92	36.86	7.93	8.37	2.62	2.86
F_3M_1	32.00	32.91	8.25	8.64	2.49	2.74
F_3M_2	30.40	31.27	8.09	8.57	2.29	2.53
F_3M_3	31.15	33.00	8.40	8.72	2.38	2.64
CD (p ≤ 0.05)	**2.12**	**2.09**	**0.24**	**0.27**		

A significant influence on TSS/acid ratio was noted due to fertilizers and micronutrients (Table-2). Fertilizer dose F_2 (FYM-50 kg/vine + 2 times recommended dose-NPK: 1110, 454, 940 g/vine) recorded the highest TSS/ acid ratio (35.60 and 36.46) during 1st and 2nd year respectively but in 2nd year it was statistically at par with fertilizer dose,F_1 : FYM-50 kg/vine + Recommended dose-NPK: 555, 227, 470 g/vine (34.52). The lowest TSS/acid ratio (31.18 and 32.39) was recorded under fertilizer dose, F_3 (FYM-50 kg/vine + 3 times recommended dose-NPK: 1665, 681,1410g/vine) during the two years respectively. Micronutrient M_1 (Solubor-0.1%) registered maximum TSS/acid ratio (34.30 and 35.13) which was statistically at par with micronutrient M_3: Solubor-0.1% + $ZnSO_4$-0.4% (33.40 and 34.87) and micronutrient M_2 ($ZnSO_4$-0.4%) recorded minimum TSS/acid ratio (32.44 and 33.36) during the year 1st and 2nd respectively.

Micronutrients and fertilizers when applied together showed a significant influence on TSS/ acid ratio during both the years. The interaction M_1F_2 recorded highest TSS/acid ratio (36.77 and 37.37) which was followed non statistically by M_3F_2 (35.92 and 36.86) during 1st and 2nd year respectively. This may be due to maximum TSS and minimum acidity recorded in these treatments. This is in accordance with the findings of Salem *et al.*, (2004), Pushparaj (2002), Darzi (2010) and Yashwant (2010).

Main effect of fertilizers showed no significant effect on ascorbic acid whereas micronutrients exerted a significant influence on ascorbic acid during the two years (Table-2). Highest value of ascorbic acid (7.98 and 8.37 mg/100g) was recorded in vines treated with micronutrient, M_3 (Solubor-0.1% + $ZnSO_4$-0.4%) which was statistically at par with micronutrient, M_1: Solubor-0.1% (7.87 and 8.30 mg/100g) and lowest value of ascorbic acid (7.76 and 8.15 mg/100g) was noticed in micronutrient M_2 ($ZnSO_4$-0.4%) during 1st and 2nd year respectively. The combined application of micronutrients and fertilizers had significant effect on ascorbic acid during both the years.

The highest ascorbic acid was recorded in M_3F_3 combination (8.40 and 8.72 mg/100g) in 1st and 2nd year respectively which was followed non significantly by M_1F_3 (8.25 mg/100g) in 1st and M_1F_3 (8.64mg/100g) and M_2F_3 (8.57 mg/100g) in 2nd year. This improvement in ascorbic acid might be due to synthesis of its precursor glucose-6 phosphate during conversion of starch into sugars and by the catalytic influence of growth substances in the biosynthesis of ascorbic acid. This is in accordance with the findings of Koul(1995), Bhat *et al.,* (1997) and Gyulakhmedov and Gasanova (1990).

The data on benefit cost ratio revealed that various levels of fertilizer dose and micronutrient applications significantly influenced benefit-cost ratio (Table 2). Fertilizer dose at moderate level, F_2 (FYM-50 kg/vine + 2 times recommended dose-NPK: 1110, 454, 940 g/vine) resulted in maximum benefit cost ratio (2.61 and 2.88) and fertilizer dose at highest level, F_3 (FYM-50 kg/vine + 3 times recommended dose-NPK: 1665, 681,1410g/vine) resulted in minimum benefit cost ratio of 2.39 and 2.64 during the two years respectively. Highest benefit cost ratio (2.58 and 2.85) was recorded in micronutrient M_1 (Solubor-0.1%) and lowest benefit cost ratio (2.41 and 2.67) was noticed in micronutrient M_2 ($ZnSO_4$-0.4%) during 1st and 2nd year respectively. The interaction effect of micronutrient and fertilizer dose (M_1F_2) had shown highest benefit cost ratio of 2.67 and 2.99 in two years respectively.

Thus it can be concluded from the present investigation that applying the fertilizer dose,

F_2 (FYM-50 kg/vine + 2 times recommended dose-NPK: 1110, 454, 940 g/vine) and micronutrient M_1 (Solubor-0.1%) were most effective in improving physico-chemical aspects of berry and maximizing benefit cost ratio.

References

A. O. A. C. 1990. Official and Tentative Methods of Analysis. Association of Official Agricultural Chemists.15th edition. Washington, D.C., USA, pp. 484.

Abd El-Razek, E., Treutter, D., Saleh, M. M. S., El-Shammaa, M., Fouad, A. A. and Abdel-Hamid, N. 2011. Effect of nitrogen and potassium fertilization on productivity and fruit quality of Crimson Seedless grape. *Agriculture and Biology Journal of North America*2(2): 330-340.

Anonymous, 2019. FAO. Food and Agricultural Organization. Statistical Database on World Fruit Production. www.fao.org.

Anonymous, 2018-19. District wise/kind wise area and production of major horticultural crops in Jammu and Kashmir state for the year 2017. Department of horticulture, Jammu and Kashmir Government.

Bhat, A. R., Sofi, A. G., Mir, M. A. and Gani, M. R. 1997. Effect of pre-harvest spray of calcium and potassium on some quality characteristics of cherry cv. Makhmali. *Indian Journal of Horticulture*54 : 19-24.

Darzi, M. S. 2010. Studies on foliar applications of boron and calcium on yield, quality and shelf life of sweet cherry cv. *Bigarreau Noir Grossa* (Misri). Ph.D Thesis submitted to Sher-e-Kashmir Universty of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar.

FAO. Food and Agricultural Organization. Statistical Database on World Fruit Production. www.fao.org.

Ganai, N. A. 2006. Effect of Pre-harvest calcium and boron application on the quality and yield of apple (*Malus x domestica* Borkh.) cv. Red Delicious under temperate conditions of Kashmir. Ph.D Thesis submitted to Sher-e-Kashmir Universty of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar, India.

Girgis, V. H., Eshennawy, S. I. and El-Mogy, M. M. 1998. Studies on the optimum N:K ratio required for Thompson Seedless grapevines. *Journal of Agricultural Sciences Mansoura University* 23: 5633-5640.

Gomez, K. A. and Gomez, A. A. 1984. *Statistical Proceedings for Agriculture Research* (2nd edn.), John Wiley and Sons Inc., New York.

Gyul-akhmedov, A. N. and Gasanova, S. F. 1990. Effect of micro elements on apple yield and quality. *Izvestiya Akademii Nauk Azerbaidzhanskoi SSR, Biologicheskie Nauki* 3: 3-17.

Mazumdar, B. C. and Majumder, K. 2003. *Methods on physico-chemical analysis of fruits*. Daya Publishing House, Delhi.

Mostafa, E. A. M., El-Shamma, M. S. and Hagagg L. F. 2006. Correction of boron deficiency in grape vines of Bez EL-Anza cultivar. *American-Eurasian Journal of Agricultural and Environmental Science* 1(3): 301-305.

Nikkah, R., Nafar, H., Rastgoo, S and Dorostkar, M.2013.Effect of foliar application of boron and zinc on qualitative and quantitative fruit characteristics of grapevine (*Vitis vinifera* L.). *International Journal of Agriculture and Crop Sciences* 6(9) : 485-492.

Koul, O. P. 1995. Effect of foliar sprays of

calcium nitrate, zinc sulphate and ethrel on the fruit characteristics of Flordasun Peach (*Prunus persica* L. Batsch). M.Sc. Thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar.

Palanichamy, V., Jindal, P. C. and Singh, R. 2004. Studies on severity of pruning in grapes (*Vitis vinifera*) cv. Pusa Navrang-A Teinturier hybrid. *Agricultural Science Digest* 24(2): 145-147.

Prabu, P. C. and Singaram, P. 2001. Effect of micronutrients on growth and yield of grapes. *Madras Agricultural Journal* 88(1-3): 45-49.

Pushparaj, R. 2002. Effect of micronutrient spray and organic manuring on growth and productivity of Dusehri Mango. M.Sc. Thesis submitted to Punjab Agricultural University, Ludhiana.

Ranganna, S. 1986. Manual of analysis of fruits and vegetable products. Tata McGraw Hill Publishing Co. Ltd., New Delhi, pp. 524.

Salem, A. J., Kilany, A. E. and Shaker, G. S. 2004. The influence of NPK, phosphorus source and potassium foliar application on growth and fruit quality of Thompson Seedless grapevines. *Proceedings XXVI IHC viticulture-living with limitations. Acta Horticulture*640: 163-173.

Shah, R. A. 2004. Effect of boron application on yield and quality of grape (*Vitis vinifera* L.) cv. Thompson seedless under temperate conditions of Kashmir. Thesis submitted to Sher-e-Kashmir University of Agricultural sciences and Technology of Kashmir, Shalimar Srinagar, India.

Yashwant, S. H. 2010. Effect of micronutrients on fruitset, yield and quality of Satluj Purple Plum. M.Sc. Thesis submitted to Punjab Agricultural University, Ludhiana.