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Research Paper

Combined effect of budload, fertilizer and micronutrient application on production, quality and economics of grape cv. Sahebi

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ABSTRACT

The investigation on combined effect of budload, fertilizer and micronutrient application was carried out in model grapevine orchard of department of Horticulture at Kralbagh, Tehsil Lar, District Ganderbal (J&K) for two consecutive years. The experiment consisted of 27 treatment combinations formed by combining 3 levels of bud load (B_1-96 buds/vine), (B_2 -128 buds/ vine) and (B_3-160 buds/vine), 3 levels of fertilizer doses F_1=FYM (50 kg/vine) + recommended dose (NPK: 555, 227, 470g/vine), F_2=FYM (50 kg/vine)+ 2 times recommended dose (NPK: 1110, 454, 940g/vine), F_3=FYM (50 kg/vine)+ 3 times recommended dose (NPK: 1665, 681, 1410g/vine) and 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%) replicated thrice with a double plot size in a completely randomized block design. The combination $B_2F_2M_1$ (Bud load B_2- 128 buds/vine, 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%)) recorded the maximum percentage of fruitful shoots per vine, fruit yield, TSS/ acid ratio and benefit- cost ratio. However maximum bunch weight and juice percent was recorded in the combination $B_2F_3M_1$ (Bud load B_2- 128 buds/vine, fertilizer dose F_3=FYM (50 kg/vine) + 3 times recommended dose (NPK: 1665, 681, 1410g/vine) and micronutrient M_1- (Solubor 0.1%) It is concluded that combination $B_2F_2M_1$ is most effective for influencing production, quality and benefit cost ratio of grape cv. Sahebi

Key words: Grape, micronutrient, production, quality, sahebi, yield,

Grape (*Vitis vinifera* L.) belonging to family Vitaceae is one of the most economical fruit crops of the world. Grape cultivation is believed to have originated in Armenia near the Caspian sea in Russia from where it seems to have spread westward to Europe and eastwards to Iran and Afghanistan. It was introduced into India in 1300 A.D by muslim invaders from Iran and Afghanistan. It is a refreshing fruit, rich in sugars, acids, minerals, vitamins and tannins and can be eaten raw or can be used for making jam, juice, jelly, vinegar, wine, raisins, molasses and grape seed oil. Tannins are present in skin and seeds of berries which influence palatability of fruits.

Around 71% of world grape production is used for wine, 27% as fresh fruit and 2% as dried fruit. Grapes are being cultivated on an area of about 7.5 million hectares giving a total production of 77.5 million tonnes (FAO, 2021) with China as the leading producer. However in India, it is being cultivated on an area of 148 thousand hectares with production of 3.7 million tonnes (NHB, 2022) with Maharashtra as leading producer.

In Kashmir, grape is mainly confined to Repora area of district Ganderbal with a production of about 1615 MTs from an area of about 232 hectares (Anonymous, 2022) which is very less when compared to other states of India. The possible reason is non-adoption of scientific canopy and nutrient management practices particularly pruning and macro and micro-nutrient application etc. Proper pruning plays an important role in maintaining a balance between vegetative and a reproductive growth thereby improving yield, size and quality of fruit. Proper application of nutrients is necessary to meet the growth and reproductive needs of the grapevine. Further, the optimum combination of the budload and macro and micro nutrient application play an important role in regulating the tree performance. Hence the present study was carried out to standardize the combination of bud load, fertilizer dose and micronutrient application for optimum production, quality and economics of grape cv. Sahebi.

MATERIALS AND METHODS

The experiment was carried out to assess the combined effect of bud load, fertilizer and micronutrient levels on production, quality 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 (2018 and 2019). The experiment consisted of 27 treatment combinations formed by combining 3 levels of bud load (B_1-96 buds/vine, B_2 -128 buds/ vine and B_3-160 buds/vine), 3 levels of fertilizer doses, F_1=FYM (50 kg/vine) + Recommended dose (NPK: 555, 227, 470 g/vine), F_2=FYM (50 kg/vine)+ 2 times recommended dose (NPK: 1110, 454, 940 g/vine), F_3=FYM (50 kg/vine)+ 3 times recommended dose (NPK: 1665, 681, 1410 g/vine and 3 levels of micronutrients viz. M_1 (Solubor 0.1%), M_2 (ZnSO4 0.4%) and M_3 (Solubor 0.1% + ZnSO4 0.4%)replicated thrice with a double plot size in a completely randomized block design. Data on percentage of fruitful shoots/vine was calculated by dividing the number of fruitful shoots with total number of shoots emerged and multiplying by 100. 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 (1974). The weight of five bunches from each replication was observed on laboratory balance and the mean weight per bunch was recorded in grams. Fruit juice percentage was measured as per the method described by Mazumdar and Majumder (2003).

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 ^{0}Brix. The readings were corrected at 20ºC with the help of temperature correction chart (A.O.A.C., 1990). 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., 1990) and was expressed in terms of tartaric acid. TSS/acid ratio was calculated by dividing the values of TSS by the values of acidity. Benefit cost ratio 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 (1984).

RESULTS AND DISCUSSION

The treatment combination $B_2F_2M_1$ significantly influenced the percentage of fruitful shoots per vine, fruit yield, TSS/ acid ratio and benefit- cost ratio. However the treatment combination $B_2F_3M_1$ significantly affected bunch weight and juice percent. The interaction $B_2F_2M_1$ registered highest percentage of fruitful shoots/vine (46.36 and 47.22%) followed by $B_2F_2M_3$ (46.17 and 47.16%) during the two years respectively (table-1).This is due to the fact that this treatment combination resulted in moderated vigor vines (minimal competition for assimilates) which are usually more fruitful because of optimum nutrient supply to vines and also shoots developing on exposed canes are generally more fruitful and exhibit better vegetative growth than shoots on shaded canes. The results are in agreement with those reported by Salem *et al.* (1997) and Fawzi *et al.* (2010). Also the medium dose of fertilizers resulted in better fruitset thereby produced more fertile buds through the synthesis of higher rates of ribonucleic acids in the buds. This is in accordance with the findings of Maatouk e*t al.* (1988) and Girgis *et al.* (1998). Further boron plays an important role in fruiting process by influencing metabolism of nitrogen biosynthesis and translocation of carbohydrates. These results are in conformity with the findings of Ali (2000), Ahmad and Abd El-Hameed (2003) and Mostafa *et al*. (2006).

Highest yield was recorded in combination $B_2F_2M_1$ (22.98 and 26.89 kg/vine) during the two years respectively but it was statistically at par with $B_2F_2M_3$ (22.75kg/vine) during the Ist year (table-1). This may be attributed to increase in both number of clusters/vine and cluster weight in this treatment combination. This is in line with the reports of Dhillon *et al.* (1992), Omar and Abdel-Kawi (2000), Salem *et al.* (2004) and Fawzi *et al.* (2010). Further boron has a tremendous role in improving flower set, pollen viability, germination and fertilization, fruit set, berry size and reducing fruit drop and shot berries. These results are in conformity with the findings of Jindal *et al.* (1982) and Prabu and Singaram (2001).

Table 1: Influence of budload, fertilizer and micronutrient application on fruitful shoots/vine, yield and bunch weight of grape cv. Sahebi

Treatments	Fruitful shoots/ vine (%)		Yield (Kg/vine)		Bunch weight(g)	
	1st year	2nd year	1st year	2nd year	1st year	2nd year
$B_1F_1M_1$	43.54	44.38	16.46	19.56	377.26	420.52
$B_1F_1M_2$	43.70	44.57	15.78	18.53	370.82	408.80
$B_1F_1M_3$	43.37	44.17	16.11	18.93	372.54	414.21
$B_2F_1M_1$	45.52	46.72	21.62	24.61	441.57	450.67
$B_2F_1M_2$	45.24	46.32	20.47	23.93	431.86	445.38
$B_2F_1M_3$	45.36	46.55	20.81	24.35	437.38	447.92
$B_3F_1M_1$	41.44	42.18	19.80	21.70	348.21	364.72
$B_3F_1M_2$	40.88	41.59	17.91	20.90	340.76	358.83
$B_3F_1M_3$	41.18	41.80	18.80	21.15	344.68	360.26
$B_1F_2M_1$	44.15	45.28	17.74	21.48	392.96	432.88
$B_1F_2M_2$	43.82	44.79	16.66	21.68	380.52	420.96
$B_1F_2M_3$	44.00	45.00	17.21	20.85	385.75	427.36
$B_2F_2M_1$	46.36	47.22	22.98	26.89	454.81	478.26
$B_2F_2M_2$	45.87	47.00	22.36	24.98	448.92	454.21
$B_2F_2M_3$	46.17	47.16	22.75	25.85	452.70	466.62
$B_3F_2M_1$	42.58	43.28	20.55	23.03	352.81	373.51
$B_3F_2M_2$	41.76	42.45	20.07	22.15	348.55	369.67
$B_3F_2M_3$	42.17	42.77	20.38	22.09	350.72	366.83
$B_1F_3M_1$	43.10	44.00	17.61	19.29	419.29	441.71
$B_1F_3M_2$	42.77	43.67	16.22	17.97	404.28	436.71
$B_1F_3M_3$	42.90	43.88	17.04	18.61	408.97	438.52
$B_2F_3M_1$	44.76	45.81	22.00	26.28	470.10	497.62
$B_2F_3M_2$	44.27	45.46	21.04	24.43	461.01	485.12
$B_2F_3M_3$	44.41	45.66	21.52	25.71	465.35	492.00
$B_3F_3M_1$	40.67	40.68	19.26	22.41	368.26	388.00
$B_3F_3M_2$	39.52	39.77	18.05	21.24	356.00	375.12
$B_3F_3M_3$	40.21	40.26	18.47	21.68	360.23	378.00
$CD_{(0.05)}$	0.23	0.19	0.55	0.6	6.67	6.81

The combination $B_2F_3M_1$ had registered maximum bunch weight (470.10 and 497.62 g) which was statistically at par with $B_2F_3M_3$ (465.35 and 492.00 g) during the two years respectively (table-1). This may be due to more number of leaves which resulted in better photosynthesis and optimum uptake of nutrients in this treatment combination. These results agreed with the findings of Omar and Abdel-Kawi (2000) and Fawzi *et al.* (2010). This treatment combination resulted in more accumulation of assimilates for higher bunch weight due to better photosynthetic activity of the vine. Similar findings were reported by Gay Eynard (2000) and Abd El-Razek *et al.* (2011).Also boron increases the bunch weight due to its role in improving the berry set of vines. These results are in agreement with the findings of Usha and Singh (2002) and Mostafa *et al.* (2006).

Maximum juice content was reported in combination $B_2F_3M_1$ (71.68 and 73.42%) during the two years respectively (table-2). This increase in juice percentage is due to maximum berry weight in this treatment combination. Similar observation has been recorded by Mohammad *et al.* (1993), Prabu and Singaram (2001), Palanichamy *et al.* (2004), Shah (2004), Gill and Sharma (2005) and Abd El-Razek *et al*. (2011).

Table 2- Influence of budload, fertilizer and micronutrient application on juice content, TSS/Acid ratio and B/C ratio of grape cv. Sahebi

Treatments	Juice content (%)		TSS/Acid ratio		B/C ratio	
	1st year	2nd year	1st year	2nd year	1st year	2nd year
$B_1 F_1 M_1$	66.47	67.62	34.3	36.02	2.17	2.53
$B_1F_1 M_2$	66.00	67.29	32.34	33.84	2.06	2.36
$B_1F_1 M_3$	65.74	66.80	33.08	34.84	2.11	2.42
$B_2F_1 M_1$	69.16	71.55	40.90	41.56	2.97	3.18
$B_2F_1 M_2$	68.84	71.00	38.45	39.29	2.77	3.08
$B_2F_1 M_3$	68.60	70.84	39.71	41.30	2.82	3.13
$B_3F_1 M_1$	63.28	64.00	27.40	27.75	2.66	2.75
$B_3 F_1M_2$	62.83	63.67	27.60	27.89	2.35	2.63
$B_3F_1 M_3$	60.64	62.19	26.57	28.14	2.49	2.65
$B_1F_2 M_1$	67.53	68.82	36.00	37.95	2.30	2.74
$B_1F_2 M_2$	67.20	68.71	34.31	35.76	2.12	2.55
$B_1F_2 M_3$	66.82	68.54	34.66	37.64	2.20	2.64
$B_2F_2 M_1$	69.74	72.60	45.02	43.46	3.05	3.42
$B_2F_2 M_2$	69.52	72.38	40.44	41.84	2.97	3.13
$B_2F_2 M_3$	69.40	71.74	44.65	43.26	3.02	3.26
$B_3F_2 M_1$	64.39	65.12	29.28	30.70	2.66	2.83
$B_3F_2 M_2$	64.00	64.86	27.60	27.84	2.60	2.72
$B_3F_2 M_3$	63.74	64.58	28.44	29.67	2.64	2.70
$B_1F_3 M_1$	68.42	70.52	31.37	32.07	2.22	2.30
$B_1F_3 M_2$	68.13	69.63	30.01	30.49	1.99	2.10
$B_1F_3 M_3$	67.80	69.35	30.51	31.92	2.12	2.20
$B_2F_3 M_1$	71.68	73.42	38.62	38.89	2.84	3.25
$B_2F_3 M_2$	71.25	73.00	36.17	37.46	2.68	2.98
$B_2F_3 M_3$	71.00	72.82	37.54	39.38	2.76	3.16
$B_3F_3 M_1$	65.56	66.37	26.01	27.78	2.41	2.69
$B_3F_3 M_2$	65.13	66.00	25.01	25.86	2.22	2.51
$B_3F_3 M_3$	64.68	65.53	25.40	27.69	2.27	2.57
$CD_{(0.05)}$	0.35	0.40	1.70	1.60		

Maximum TSS/acidity ratio (45.02 and 43.46) was noticed in $B_2F_2M_1$ combination which was statistically at par with combination $B_2F_2M_3$ (44.65 and 43.26) during the two years respectively (table-2). This may be due to maximum TSS and minimum acidity recorded in this treatment combination. These results are in accordance with Delgado *et al.* (2004), Salem *et al.* (2004), Gill and Sharma (2005), Darzi (2010), Fawzi*et al.* (2010) and Yashwant (2010).

The combined effect of budload, fertilizer dose and micronutrients ($B_2F_2M_1$) also exhibited maximum benefit cost ratio of 3.05 and 3.42 during the two years, respectively (table-2). The calculations involved in computing benefit cost ratio are given in table -3 and 4.

Table-3 Total cost details of the experiment during the two years

S. No.	Treatments	Non Recurring cost (Rs) per hectare	Recurring cost (Rs) / ha 1st year	Recurring cost (Rs) / ha 2nd year	Total Basic cost (Rs) / ha 1st year	Total Basic cost (Rs) / ha 2nd year	Treatment cost (Rs)/ ha	Total cost (Rs)/ ha 1st year	Total cost (Rs) / ha 2nd year
1	$B_1F_1M_1$	53655	247680	253920	301335	307575	209453	510788	517028
2	$B_1F_1M_2$	53655	245760	252480	299415	306135	209261	508676	515396
3	$B_1F_1M_3$	53655	246720	252960	300375	306615	210317	510692	516932
4	$B_2F_1M_1$	53655	269280	280320	322935	333975	212880	535815	546855
5	$B_2F_1M_2$	53655	265440	278880	319095	332535	212688	531783	54223
6	$B_2F_1M_3$	53655	266400	279840	320055	333495	213744	533799	547239
7	$B_3F_1M_1$	53655	259200	267840	312855	321495	217450	530305	538945
8	$B_3F_1M_2$	53655	254880	265920	308535	319575	217258	525793	536833
9	$B_3F_1M_3$	53655	256320	266880	309975	320535	218314	528289	538849
10	$B_1F_2M_1$	53655	251040	257760	304695	311415	223709	528404	535124
11	$B_1F_2M_2$	53655	248640	254400	302295	308055	223517	525812	531572
12	$B_1F_2M_3$	53655	250080	255840	3037355	309495	224573	528308	534068
13	$B_2F_2M_1$	53655	274080	282720	327735	336375	227136	554871	563511
14	$B_2F_2M_2$	53655	270720	280320	324375	333975	226944	551319	560919
15	$B_2F_2M_3$	53655	272160	281280	325815	334935	228000	553815	562935
16	$B_3F_2M_1$	53655	264000	272640	317655	326295	231706	549361	558001
17	$B_3F_2M_2$	53655	261120	268320	314775	321975	231514	546289	553489
18	$B_3F_2M_3$	53655	262560	269280	316215	322935	232570	548785	555505
19	$B_1F_3M_1$	53655	245760	252480	299415	306135	237965	537380	544100
20	$B_1F_3M_2$	53655	243360	250080	297015	303735	237773	534778	541508
21	$B_1F_3M_3$	53655	244800	250560	298455	304215	238829	537284	543044
22	$B_2F_3M_1$	53655	264960	278400	318615	332055	241392	560007	573447
23	$B_2F_3M_2$	53655	264000	274560	317655	328215	241200	558855	569415
24	$B_2F_3M_3$	53655	264000	276480	317655	330135	242256	559911	572391
25	$B_3F_3M_1$	53655	253440	264960	307095	318615	245962	553057	564577
26	$B_3F_3M_2$	53655	252000	263040	305655	316695	245770	551425	562465
27	$B_3F_3M_3$	53655	252960	264000	306615	317655	246826	553441	564481

Non recurring cost include bower system, fencing, layout, pit digging, plant material, pit filling and miscellaneous. Recurring cost include hoeing, fungicide/insecticide spray, irrigation, tools and implements watch and ward, harvesting, grading, packing and transportation

Table-4 Total income details of the experiment

S.no	Treatments	Yield (t/ha) 1st yr	Yield (t/ha) 2nd yr	Income from fruit (Rs)/ha 1st yr	Income from fruit (Rs)/ ha 2nd yr	Income from weeds (Rs)/ha	Total income (Rs)/ha 1st yr	Total income (Rs)/ha 2nd yr	Total cost (Rs)/ha 1st yr	Total cost (Rs)/ha 2nd yr	Net income (Rs)/ha 1st yr	Net income (Rs)/ha 1st yr	B/C 1st yr	B/C 2nd yr
1	$B_1F_1M_1$	7.901	9.389	1580160	1783872	40000	1620160	1823872	510788	517028	1109373	1306844	2.17	2.53
2	$B_1F_1M_2$	7.574	8.894	1514880	1689936	40000	1554880	1729936	508676	515396	1046204	1214540	2.06	2.36
3	$B_1F_1M_3$	7.733	9.086	1546560	1726416	40000	1586560	1766416	510692	516932	1075868	1249484	2.11	2.42
4	$B_2F_1M_1$	10.378	11.813	2075520	2244432	40000	2115520	2284432	535815	546855	1579705	1737577	2.95	3.18
5	$B_2F_1M_2$	9.826	11.486	1965120	2182416	40000	2005120	2222416	531783	54223	1473337	1677193	2.77	3.08
6	$B_2F_1M_3$	9.989	11.688	1997760	2220720	40000	2037760	2260720	533799	547239	1503961	1713481	2.82	3.13
7	$B_3F_1M_1$	9.504	10.416	1900800	1979040	40000	1940800	2019040	530305	538945	1410495	1480095	2.66	2.75
8	$B_3F_1M_2$	8.597	10.023	1719360	1906080	40000	1759360	1946080	525793	536833	1233567	1409247	2.35	2.63
9	$B_3F_1M_3$	9.024	10.152	1804800	1928880	40000	1844800	1968880	528289	538849	1316511	1430031	2.49	2.65
10	$B_1F_2M_1$	8.515	10.310	1703040	1958976	40000	1743040	1998976	528404	535124	1214636	1463852	2.30	2.74
11	$B_1F_2M_2$	7.997	9.730	1599360	1848624	40000	1639360	1888624	525812	531572	1113548	1357052	2.12	2.55
12	$B_1F_2M_3$	8.261	10.008	1652160	1901520	40000	1692160	1941520	528308	534068	1163852	1407452	2.20	2.64
13	$B_2F_2M_1$	11.030	12.907	2206080	2452368	40000	2246080	2492368	554871	563511	1691209	1928857	3.05	3.42
14	$B_2F_2M_2$	10.733	11.990	2146560	2278176	40000	2186560	2318176	551319	560919	1635241	1757257	2.97	3.13
15	$B_2F_2M_3$	10.920	12.408	2184000	2357520	40000	2224000	2397520	553815	562935	1670185	1834585	3.02	3.26
16	$B_3F_2M_1$	9.864	11.054	1972800	2100336	40000	2012800	2140336	549361	558001	1463439	1582335	2.66	2.83
17	$B_3F_2M_2$	9.634	10.632	1926720	2020080	40000	1966720	2060080	546289	553489	1420431	1506591	2.60	2.72
18	$B_3F_2M_3$	9.782	10.603	1956480	2014608	40000	1996480	2054608	548785	555505	1447695	1499103	2.64	2.70
19	$B_1F_3M_1$	8.453	9.259	1690560	1759248	40000	1730560	1799248	537380	544100	1193180	1255148	2.22	2.30
20	$B_1F_3M_2$	7.786	8.626	1557120	1638864	40000	1597120	1678864	534778	541508	1062342	1137356	1.99	2.10
21	$B_1F_3M_3$	8.179	8.933	1635840	1697232	40000	1675840	1737232	537284	543044	1138556	1194188	2.12	2.20
22	$B_2F_3M_1$	10.560	12.614	2112000	2396736	40000	2152000	2436736	560007	573447	1591993	1863289	2.84	3.25
23	$B_2F_3M_2$	10.099	11.726	2019840	2228016	40000	2059840	2268016	558855	569415	1500985	1698601	2.68	2.98
24	$B_2F_3M_3$	10.330	12.341	2065920	2344752	40000	2105920	2384752	559911	572391	1546009	1812361	2.76	3.16
25	$B_3F_3M_1$	9.245	10.757	1848960	2043792	40000	1888960	2083792	553057	564577	1335903	1519215	2.41	2.69
26	$B_3F_3M_2$	8.664	10.195	1732800	1937088	40000	1772800	1977088	551425	562465	1221375	1414623	2.22	2.51
27	$B_3F_3M_3$	8.866	10.406	1773120	1977216	40000	1813120	2017216	553441	564481	1259679	1452735	2.27	2.57

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