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Response of Budload and Fertilizer on Berry Shape, Quality and Shot berry disorder in Grapes cv. Sahebi

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ABSTRACT: Grape (*Vitis vinifera* L.), belonging to Vitaceae family, is considered to be one the important fruit. Besides being delicious, it is also nutritious as it is enriched with vitamins and minerals. The matter of concern related to grape cultivation in Jammu & Kashmir is its declining productivity and also the degrading quality of the produce when compared to other major producing states of the country. The possible reason for declining productivity is the unscientific approach and inappropriate cultural practices followed by growers in its cultivation. The knowledge regarding the fertilizer requirement and the optimum budload in grapes is also limited in the valley. Thus there is the need for focusing on appropriate cultural practices so as to achieve higher quality production and also increase the productivity of grapes. Bud load and fertilizer scheduling also effect the percentage of shot berries (smaller and shrivelled berries). Thus with the objective of giving proper recommendation to farmers regarding the optimum budload, fertilization and also to reduce the percentage of shot berries, an experiment was conducted in the orchard of department of horticulture, at Kralbagh, Tehsil Lar, Ganderbal. The treatments involving fertilization was tested at three levels. In the 1st treatment (F_1) FYM @ 50 Kg/ vine and macronutrients as per the recommended dose *i.e* N= 555 g/ vine; P= 227 g/ vine; K= 470 g/ vine was applied. In 2nd treatment (F_2), FYM was applied in the same quantities, however macronutrients were applied twice that of the recommended dose (*i.e* N= 1110 g/ vine; P= 454 g/ vine; K= 940 g/ vine). In treatment 3rd (F_3), macronutrients were applied thrice the recommended dose (*i.e* N= 1665 g/ vine; P= 680 g/ vine; K= 1410 g/ vine) without any change in FYM content application. The bud load treatments were also tested at three different levels *viz,* B_1: 96 buds/vine, B_2: 128 buds/ vine and B_3: 160 buds/vine. The treatments were replicated thrice and design of experiment chosen was randomized complete block design. The effect of the budload and nutrient level was assessed on the length: diameter ratio, number of seeds, TSS: Acid ratio and percentage of shot berries. The results revealed no significant influence on berry L/D ratio and number of seeds/berry. However significant effect of bud load and fertilizer levels was seen on TSS/ acid ratio and percentage of shot berries. Budload B_2 indicated maximum TSS/acid ratio to the tune of 40.17 and 40.72 during both the years of study, whereas budload, B_3 recorded minimum TSS/acid ratio (27.03 and 28.15). Fertilizer dose F_2 recorded the highest TSS/ acid ratio (35.60 and 36.46). Considering the interaction effect, highest value of TSS/acidity ratio was noticed in B_2F_2 combination (43.37 and 42.85) during the two years respectively. The minimum percentage of shot berry (10.46 and 10.00%) was produced by budload, B_2 and maximum percentage of shot berry (18.86 and 17.83%) was noticed in budload, B_3. Percentage of shot berry was minimum (13.20 and 12.46%) by the application of fertilizer dose, F_2 and maximum (16.22 and 15.14%) by fertilizer dose, F_3. In case of interaction, percentage of shot berry was lowest in B_2F_2 combination (8.91 and 8.76%) followed non-significantly by B_2F_1 (10.50 and 9.92%) during the two years respectively.

Keywords: Shot berries, Budload, TSS/ Acid ratio.

INTRODUCTION

Grape (*Vitis vinifera* L.), belonging to Vitaceae family, is considered to be one the important fruit. Besides being delicious, it is also nutritious enriched with vitamins and minerals. Botanically it is considered as berry. It is a non-climacteric fruit and the vines are deciduous and perennial. The total acreage of grapes in

India is 0.14 Million Ha with the production of 3.041 million tons which accounts to 21.72 tons/ha productivity (Anonymous, 2019). The major grapes growing state in India is Maharashtra which accounts for 62.7% of total production. Besides, it is also grown in states like Karnataka, Andhra Pradesh, Punjab and Tamil Nadu. Considering the scenario of our union territory Jammu & Kashmir, its cultivation is spread across the area of about 332 ha with the production of 1048 Metric tonnes (Anonymous, 2018-19). The matter of concern related to grape cultivation is its declining productivity and also the degrading quality of the produce when compared to other major producing states of the country. The possible reason for this is the unscientific ways and inappropriate cultural practices involved in its production. The two major concerns include the inadequate knowledge about the optimum bud load and amount of fertilization to be applied. For maintenance of sustainable productivity for a longer period of time, the two important factors to be considered are budload and fertilizer schedule. The objective of attaining a proper budload can be fulfilled by means of proper pruning practice which in turn ensures better yield of quality produce. Apart from maintaining a proper budload, care needs to be taken to supply optimum concentrations of various macro as well as micronutrients. The proper fertilizations helps in adequate development of the vines as well the enhance the production of high quality fruit. Besides grapes are also considered as 'nutrient-loving' or 'heavy-feeders' of mineral nutrients, particularly that of macronutrients. Thus considering this fact, deficiency of any of the mineral nutrient can deteriote the growth of the vines and also shall have negative effects on the yield and quality aspects of the fruit (Kumar *et al.,* 2015; Mishra *et al.,* 2016; Zhao *et al*., 2019). So in order to achieve higher quality production and also increase the productivity of grapes, there is a need to maintain proper budload and supply optimum nutrient levels. For this there is a need to provide detailed package to the farmers for better remuneration. Based on all the stated facts, the present investigation was undertaken to assess the effect of budload and fertilizers on the L/D ratio, TSS and Number of seeds and number of shot berries, so as to give proper recommendation (for budload and fertilizer dose) to the growers with the aim of obtaining higher yield as well as quality of the produce.

MATERIAL AND METHOD

For the purpose of experimentation, a model orchard of grapevine located Kralbagh (Lar tehsil) area of Ganderbal, under department of Horticulture was selected. The age of the tree was 23 years and the training system followed was the bower system. The vines were spaces at the distance of 4.3m × 4.6m. The fertilizer treatment consisted of 3-levels of fertilizer doses as shown below (Table 1):

Table 1: Fertilizer treatment details.

	FYM (Kg/ vine)	Nitrogen (g/ vine)	Phosphorus (g/ vine)	Potassium (g/ vine)
F_1	50	555	227	470
F_2	50	1110	454	940
F_3	50	1665	681	1410

Three levels of bud load treatments were selected consisting of "B_1: 96 buds/vine, B_2: 128 buds/ vine and B_3: 160 buds/vine". The design used was randomized completely block design and with three replications for each of the treatments and combinations.

An overview of experimental site. The length and diameter were measured using vernier caliper, which was later used to calculate L/D ratio. Ten berries from each bunch were randomly selected for this calculation. Thereafter the values obtained were used for L/D ratio. The number of seeds for 50 randomly selected berries from each of the replications was calculated, and expressed as average number of seeds per berry. Thereafter the percentage of shot berries obtained in each of the treatment was estimated. Small sized berries (equal to the size of black pepper or even small) were considered as shot berries. The total number of normal berries and shot berries were counted and the percentage of shot berries was thereafter determined using these values [Nangia and Bakhshi (1971); Dhillon and Sharma (1973)]. For estimating the total soluble solid content, juice was extracted from randomly selected berries. The juice obtained was filtered and total soluble solid content was determined using refractometer in °Brix. The observations recorded were thereafter corrected at a temperature of 20°C taking the help of temperature correction chart (A.O.A.C., 1990).

For determining titratable acidity (in terms of tartaric acid), a known quantity of homogenized juice was tritrated against 0.1 N NaOH solution using phenolphthalein as indicator (A.O.A.C., 1990). Thereafter the TSS/ acid ratio (also termed as sweetness index) was obtained using the above values obtained (TSS and acidity). For analysis and interpretation statistical methods described by Gomez and Gomez (1984) were followed with 5 per cent level of significance.

RESULTS AND DISCUSSION

No significant effect of budload and fertilizer dosing was seen on the shape of the fruit determined by L/D ratio (Table 2). This is because of the fact that fruit shape is determined by the genotype and is a characteristic genetic feature of a particular fruit or variety. Or findings are in conformity with Salem *et al.,* (1997); Ganai (2006). Also the results were found insignificant in this parameter for the effect of budload and fertilizer as well as non significant for their interaction (Table 1). These results are in line with the findings of Nyomora *et al.,* (2000); Palanichamy *et al.,* (2004); Nikkah *et al*., (2013).

Data presented in Table-2 indicated that significant effect of both the factors (viz 'budload and fertilizer dosage') on the percentage of shot berries. The minimum percentage of shot berry (10.46 and 10.00%) was produced by budload, B_2 (128 buds/vine) and maximum percentage of shot berry (18.86 and 17.83%) was noticed in budload, B_3 (160 buds/vine) during 1st and 2nd year respectively. Similar results have been obtained by Chadha and Kumar (1970); Gill and Sharma (2005) (Table 2). Percentage of shot berry was minimum (13.20 and 12.46%) by the application of fertilizer dose, F_2 and maximum (16.22 and 15.14%) by fertilizer dose, F_3 during the 1st and 2nd year respectively. Combined effect of budload and fertilizer dose exerted a significant effect on the percentage of shot berry during both the years. Percentage of shot berry was lowest in B_2F_2 combination (8.91 and 8.76%) followed non-significantly by B_2F_1 (10.50 and 9.92%) during the two years respectively (Table 2). The reason behind this may be the fact that adequate budload resulted in adequate nutrition to the berries which in turn enhanced fruitfulness and consequently resulted in less percentage of shot berries. Bud fruitfulness is enhanced by the nutrition provided to the vine during the previous year, as well the current year floral differentiation is influenced by the previous year's nutrition. Nitrogen content of the vines has been found directly related with the percentage of fruit set as well as percent of shot berries. Too high or too low nitrogen can lead to poor fruitset (Delgado *et al*., 2004; Cocco *et al*., 2021). All these facts indicate that fertilizer dose F_2 was successful in maintaining an adequate ratio of carbon: nitrogen which in turn reduced the incidence of shot berries in vines.

Table 2: Effect of budload and fertilizer application on berry characteristics and shot berry disorder in grape cv. Sahebi.

	L/D Ratio		No. of seeds/ berry		Shot berry		TSS/ Acid ratio	
Treatments	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
B_1	1.485	1.566	2.55	2.36	14.45	13.45	32.93	34.50
B_2	1.837	1.934	2.92	2.73	10.46	10.00	40.17	40.72
B_3	1.670	1.819	2.18	2.03	18.86	17.83	27.03	28.15
CD ($p \leq 0.05$)	**NS**	**NS**	**NS**	**NS**	**2.31**	**2.28**	**2.01**	1.97
F_1	1.699	1.815	2.36	2.33	14.36	13.67	33.35	34.52
F_2	1.632	1.753	2.62	2.33	13.20	12.46	35.60	36.46
F_3	1.661	1.751	2.66	2.47	16.22	15.14	31.18	32.39
CD ($p \leq 0.05$)	**NS**	**NS**	**NS**	**NS**	**1.14**	**1.20**	**2.09**	2.03
B_1F_1	1.494	1.583	2.33	2.33	13.82	13.27	33.18	34.90
B_1F_2	1.482	1.574	2.66	2.33	13.82	12.28	34.99	37.12
B_1F_3	1.481	1.542	2.66	2.44	15.71	14.80	30.63	31.49
B_2F_1	1.922	2.024	2.77	2.66	10.50	9.92	39.69	40.72
B_2F_2	1.748	1.872	3.00	2.66	8.91	8.76	43.37	42.85
B_2F_3	1.841	1.908	3.00	2.88	11.98	11.31	37.44	38.58
B_3F_1	1.682	1.839	2.00	2.00	18.77	17.82	27.19	27.93
B_3F_2	1.665	1.813	2.22	2.00	16.86	16.35	28.44	29.40
B_3F_3	1.663	1.805	2.33	2.11	20.96	19.32	25.47	27.11
CD ($p \leq 0.05$)	NS	NS	NS	NS	2.35	2.31	2.11	2.12

A significant influence on TSS/acid ratio was noted due to budload and fertilizers (Table 2). Budload B_2 (128 buds/vine) indicated maximum TSS/acid ratio to the tune of 40.17 and 40.72 whereas budload, B_3 (160 buds/vine) recorded minimum TSS/acid ratio (27.03 and 28.15) during the two years respectively (Table 2). These results are in accordance with Thatai *et al.,* (1987); Gill and Sharma (2005); Fawzi *et al.,* (2010). Fertilizer dose F_2 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 (34.52). The lowest TSS/acid ratio (31.18 and

32.39) was recorded under fertilizer dose F_3 during the two years respectively. Highest value of TSS/acidity ratio was noticed in B_2F_2 combination (43.37 and 42.85) during the two years respectively. These results are in accordance with Khalil *et al*., (2021); Gill and Sharma (2005); Fawzi *et al.,* (2010); Davies and Robinson (1996); Delgado *et al.,* (2004); Salem *et al.,* (2004). Application of nitrogen enhances the availability of assimilates but excessive vegetative growth is caused by higher dosage. This excessive vegetative growth leads to competition of nutrients for the berries which in turn are deprived of adequate nutrition. Phosphorus fertilization plays a very crucial role in sugar accumulation in berries. Thus enhanced phosphorus application has lead to higher total soluble solid content in berries. Potassium has a important role to play in transportation of sugars to sinks (berries). Increased polysaccharide hydrolysis to monosaccharides also is responsible for the higher total soluble solid content in the berries. This further resulted in reduced acidity due the conversion of organic acids to sugars (Rogiers *et al*., 2017). The precipitation of potassium bitartarate significantly lowers tartaric acid levels. The TSS/acid ratio was found to be in accordance with highest value of TSS and lowest value of acidity in the treatments. Interaction effect of both budload and fertilizers had a tangible impact in increasing TSS/acid ratio during the two years (Table 2).

CONCLUSION

Thus from the present investigation, it is clearly seen adequate bud load and fertilizer dosage has a significant effect on the percentage of shot berries as well as the sweetness index (TSS /Acid ratio) of the berries. Maintaining the budload @ '128 buds/vine-16 canes with 8 buds on each cane' and applying the fertilizer dose @ 'FYM-50 kg/vine + 2 times recommended dose-NPK: 1110, 454, 940 g/vine' were found to be most effective in improving berry characteristics and decreasing the percentage of shot berries in grape cv. Sahebi. Further researches still needs to be conducted which focus on the scope of fertigation in high density grape orchards and organic fruit production. The comparison between the fertilizer efficacy through direct application and fertigation also needs to be assessed in future.

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Conflict of Interest. None.

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