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EFFECT OF GROWTH REGULATORS ON QUALITY OF BER (*ZIZYPHUS MAURITIANA* LAMK) CV. UMRAN.

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ABSTRACT

There is huge potential to improve market acceptability of ber with application of growth regulators. Significant increase in fruit size traits i.e. fruit length, breadth, weight and volume was recorded with application of NAA 30 ppm. The palatability rating of fruits in terms of taste, colour and texture of fruit was recorded maximum with application of GA_3 50 ppm. For the stone related traits, the maximum reduction in stone breadth and percentage was recorded with NAA 30 ppm. There was no significant variation in stone length and weight with growth regulators.

Key words: Ber, Growth regulators, Palatability, Quality, Size, Stone.

INTRODUCTION

Ber (*Zizyphus mauritiana* Lamk) is distributed throughout the tropical and sub-tropical regions of the world. It is one of the most hardy fruit trees with wider adaptability to adverse soil and climatic conditions. This adds its value for cultivation on marginal land. India ranks first among the ber growing countries of the world. The fruit is equally relished by people of all classes. Ber is referred as the poor man's fruit as the fruit comes in the market from end of January and continues up to mid April. During this period, practically no other fresh fruit is available in abundance. At this time, peak of citrus is over and other fruits like grape, mango etc. are not ready. Only ber is available and that too at a cheaper price. Therefore, it holds demand in the market. Thus, ber enjoys supremacy among the fruits available in the market during these three months.

In Punjab, ber ranks fourth among the cultivated fruits. But more than 50 per cent of the harvested fruits remain small in size with un-even fruit surface and colour, which adversely affects the market acceptability of the fruit and profit of the fruit growers. Owing to this reason, commercial cultivation of ber has come under jeopardy and area under fruit is decreasing rapidly. It is a matter of concern how to hasten the quality of the fruits. In this regard the foliar application of growth regulators as is reported by some workers like Bal *et al.* (1982), Sandhu *et al.* (1990), Kale *et al.* (2000), Bhati and Yadav (2004) and Singh and Bal (2008) has been found useful. In the present endeavor an attempt has been made to highlight the findings of experiment undergone in ber using growth regulators.

MATERIAL AND METHODS

In the present experiment, the investigations were carried out in the Faculty of Agriculture and Forestry, Khalsa College, GNDU, Amritsar during the years 2007-08 and 2008-09. The eight years old trees of cv Umran with uniform size and vigour were selected for the experiment. The trees were sprayed with Plant Growth Regulators during the 3rd week of October and again after one month of previous spray. Two growth regulators naphthalene acetic acid (NAA) and gibberallic acid (GA_3) in different concentrations i.e. 10, 30 and 50 ppm each in addition to water as control were sprayed on the plants. There were three replications each with one tree per replication. The trees were sprayed uniformly by using Knapsack sprayer with flood jet nozzle. Five uniform branches per tree were selected and tagged for study. At the time of harvesting, 50 fruits per replication were randomly taken and the observations were recorded on fruit size related traits

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viz. fruit length (cm), fruit breadth (cm), fruit weight (g), fruit volume (cc); stone size related traits viz. stone length (cm), stone breadth (cm), stone weight (g) and stone percentage along with palatability rating of mature fruits. The fruit and stone length and breadth were recorded with Vernier's calipers. The fruit and stone weight was recorded by weighing 50 fruits on pan balance. The fruit volume was measured by water displacement method. The palatability rating including organoleptic quality, fruit colour and fruit surface were recorded as per Hedonic scale by a panel of five judges.

RESULTS AND DISCUSSION

In the present investigations, the effect of varying concentrations of two of the most widely commercial formulations of PGRs i.e. naphthalene acetic acid (NAA) and gibberellic acid (GA_3) on the consumer acceptability of ber was studied and the results are presented and discussed as follows:

The effect of PGRs on size relate traits of ber is presented in Table 1. The perusal of the table revealed that, for fruit length, four out of the seven treatments improved it significantly over control and the application of NAA 30 ppm proved to be the best followed by NAA 10 ppm. For fruit breadth, there was significant improvement with four out of seven treatments viz. NAA 10 and 30 ppm and GA_3 30 and 50 ppm. The maximum breadth of fruits was obtained with NAA 30 ppm (9.09 %) followed by GA_3 50 ppm (7.69 %). Similar results depicting beneficial effects of NAA and GA_3 in improving fruit length and breadth have been reported by Singh and Singh (1976) who reported that NAA 10 ppm sprayed on ber cv. Banarasi Karaka resulted in maximum fruit size (length x breadth). Bal *et al.* (1984, 1986 and 1988) reported that fruit size of ber cv. Sanaur-5 and Umran increased significantly with NAA 25 ppm applied at slow growth phase of fruit development during the months of October and November. Similar findings have also been suggested by Patil and Patil (1979), Kumar and Babu (1987), Banker and Prasad (1990), Pandey (1999) and Aulakh *et al.* (2005) who reported increased fruit length with foliar applications of NAA and GA_3. This increase in fruit length can be attributed to the involvement of PGRs in cell division, cell expansion and increased volume of inter-cellular spaces in the mesocarpic cells. The application of NAA might have a role in increasing the auxin level of fruits which, in turn, might have helped in the development of fruit components as there is direct correlation between auxin content and fruit growth in several plants as suggested by Krishnamoorthy (1981).

The maximum average fruit weight was obtained with application of NAA 30 ppm (23.86 g) followed by GA_3 30 ppm (23.03 g). All the treatments had beneficial effects on ber fruit weight and only three of the treatments viz., NAA 10 ppm, GA_3 30 ppm and GA_3 50 ppm were significantly better than control. There was maximum increase of 18.40 per cent in fruit weight with application of NAA 30 ppm. This was closely followed by 14.27 per cent increase with application of GA_3 30 ppm. Similar reports of increased fruit weight with exogenous foliar application of NAA have been presented by Bal *et al.* (1982, 1984, 1986, 1988), who found the dose of NAA 25 ppm to be most suitable in increasing fruit weight of ber cvs. Umran, Sanaur-2 and

TABLE 1: Effect of plant growth regulators on fruit size related traits of ber cv. Umran

	Treatment	Fruit length (cm)			Fruit breadth (cm)			Fruit weight (g)			Fruit volume (cc)		
		2007-08	2008-09	Mean	2007-08	2008-09	Mean	2007-08	2008-09	Mean	2007-08	2008-09	Mean
	NAA 10ppm	4.33	4.39	4.36	3.09	3.02	3.06	21.51	21.89	21.70	22.99	23.21	23.10
	NAA 30ppm	4.41	4.45	4.43	3.10	3.14	3.12	23.69	24.03	23.86	24.29	24.55	24.42
	NAA 50ppm	3.99	3.98	3.98	2.83	2.78	2.80	21.60	21.41	21.51	23.01	22.99	23.00
	GA_3 10ppm	4.26	4.20	4.23	2.93	3.01	2.97	21.18	21.52	21.35	23.21	23.13	23.17
	GA_3 30ppm	4.22	4.30	4.26	3.09	3.03	3.06	22.94	23.11	23.03	24.11	24.04	24.07
	GA_3 50ppm	4.30	4.24	4.27	3.03	3.13	3.08	21.88	22.37	22.13	23.16	23.52	23.34
	Control	4.01	3.99	4.00	2.85	2.86	2.86	19.78	20.51	20.15	21.99	22.53	22.26
C.D. (5%)	Treatment(s)	0.26			0.19			1.70			1.05		
	Year of application	N.S.			N.S.			N.S.			N.S.		
	Interaction	N.S.			N.S.			N.S.			N.S.		

Sanaur-5. Similarly, Banker and Prasad (1990) reported that fruit weight in ber cv. Gola was significantly increased by application of GA_3 30 ppm and NAA 30 ppm. Pandey (1999) reported that GA_3 15 ppm and NAA 10, 15 or 20 ppm increased the fruit weight in Banarasi Karaka cultivar of ber. Kale *et al.* (2000), Singh and Randhwa (2001) and Singh and Bal (2008) corroborated these findings. The studies showed that mean fruit volume for ber was 23.25 cc in 2007-08 and 23.42 cc in 2008-09. The mean range of fruit volume was 22.26 cc (control) to 24.42 cc (NAA 30 ppm). Three out of six treatments improved the fruit volume significantly over control. The maximum improvement was 9.70 per cent (NAA 30 ppm) followed by 8.14 per cent (GA_3 30 ppm). The results confirmed the investigations of Bal and Chohan (1981), Sandhu *et al.* (1990), Masalkar and Wavhal (1991) and Pandey (1999) who reported significant increase in fruit volume of ber with application of NAA and GA_3. However, Bal *et al.* (1982) reported that application of plant growth regulators had no significant effects on fruit volume in ber. The increase in fruit weight and volume can be attributed the exogenous supply of PGRs which might have increased the mobilization of food and minerals from other parts of the plant towards developing fruits that are extremely active metabolic sinks which, in turn, could have increased the fruit weight and volume (Jackson, 1963).

The larger fruit size can attract immediate attention in the market but to convert onlooker to a buyer, the fruits must be having better organoleptic properties which include fruit palatability, fruit colour, surface texture and uniformity. Thus in improvement of any fruit, we cannot compromise for taste and organoleptic qualities. These will no use to get better sized fruits with higher yield until the natural taste and flavor is maintained or rather improved. The application of exogenous PGRs can bring changes in chemical properties of fruits which can deteriorate or improve the flavor thus the evaluation of palatability of treated fruits was carried out and the result are presented in Table 2. The mean range for palatability rating varied 6.30 to 7.41 with mean of 6.86. The minimum palatability rating under Hedonic scale was given to fruits treated with GA_3 10 ppm, thus fruits was classified as slightly desirable. Even the control treatments had palatability rating of 6.56, but the difference was non- significant and fruits were kept under same category. The application of GA_3 30 ppm slightly improved the organoleptic qualities of fruit but the improvement of 4.65 percent over control was still non- significant. Further increase in concentration of GA_3 to 50 ppm gave the maximum palatability rated fruits with average value of 7.42 and significant improvement of 13.11 percent over control and the fruits were moderately desirable. Thus it can be concluded that with increase in concentration of GA_3, the palatability rating increased. The application of NAA 30 ppm also gave significant improvement in palatability rating over control with an increase of 8.82 percent over control. The foliar application of PGRs might have resulted in better flow of metabolic products towards developing fruits and better assimilation of these products with in the fruit which ultimately improved the taste. Similar results have been reported by earlier workers like Singh and Randhawa (2001) who found that the highest palatability rating for Umran ber was obtained with NAA 60 ppm. For the same cultivar of ber Chahal and Bal (2004) reported higher average organoleptic ratings in the fruits treated with GA_3.

The better sized and tasty fruits cannot provide full value to consumer money if after consuming the fruit, they encounter bigger stone within the fruit. Thus an ideal ber fruit must have smaller sized stone. It is a common misconception that bigger sized ber fruits have bigger stone. The effects of PGRs on stone characteristics of ber were evaluated and are presented in Table 3. For stone length, the average value over two years varied

TABLE 2: Effect of plant growth regulators on palatability rating of ber cv. Umran

	Treatment	Year of Application 2007-08	2008-09	Mean
	NAA 10ppm	6.61	6.79	6.70
	NAA 30ppm	7.31	6.97	7.14
	NAA 50ppm	7.09	7.00	7.05
	GA_3 10ppm	6.19	6.30	6.24
	GA_3 30ppm	6.71	7.02	6.87
	GA_3 50ppm	7.43	7.41	7.42
	Control	6.55	6.57	6.56
	Treatment(s)		0.51	
C.D. (5%)	Year of application		NS	
	Interaction		NS	

TABLE 3: Effect of plant growth regulators on stone related traits of ber cv. Umran

		Stone length (cm)			Stone breadth (cm)			Stone weight (g)			Stone percentage (%)		
	Treatment	2007-08	2008-09	Mean	2007-08	2008-09	Mean	2007-08	2008-09	Mean	2007-08	2008-09	Mean
	NAA 10ppm	2.29	2.25	2.27	0.94	0.88	0.91	1.43	1.50	1.46	6.63	6.85	6.74
	NAA 30ppm	2.28	2.24	2.26	0.81	0.80	0.81	1.40	1.45	1.42	5.90	6.05	5.98
	NAA 50ppm	2.35	2.29	2.32	0.85	0.90	0.87	1.45	1.43	1.44	6.74	6.67	6.70
	GA_3 10ppm	2.35	2.39	2.37	0.88	0.98	0.93	1.42	1.46	1.44	6.70	6.84	6.77
	GA_3 30ppm	2.47	2.41	2.44	0.89	0.96	0.93	1.47	1.42	1.45	6.82	6.32	6.57
	GA_3 50ppm	2.34	2.28	2.31	0.80	0.82	0.81	1.40	1.45	.42	6.13	6.26	6.20
	Control	2.49	2.51	2.50	0.96	0.99	0.98	1.54	1.51	1.53	7.81	7.40	7.61
C.D. (5%)	Treatment(s)		NS			0.11			NS			0.85	
	Year of application		NS			NS			NS			NS	
	Interaction		NS			NS			NS			NS	

between 2.26 cm (NAA 30 ppm) and 2.50 cm (control). Although all the treatments decreased the stone length but the critical difference was non significant and thus bears no practical importance. There was significant reduction of 17.86 per cent in stone breadth with the application of NAA 30 ppm. Two other treatments i.e. GA_3 and NAA 50 ppm decreased stone breadth significantly over control. The weight of ber stone varied between 1.42 - 1.53 g for all the treatments. The minimum stone weight was obtained with application of NAA 30 ppm and GA_3 ppm, but their difference from control was non-significant and thus the practical vitality is negated. Another stone character related to consumer preference is the stone percentage in the fruit. All the treatments except GA_3 10 ppm decreased the stone percentage significantly in ber with maximum decrease of 21.45 per cent over control obtained with the application of NAA 30 ppm followed by 18.59 per cent decrease by GA_3 50 ppm. Thus to reduce the stone size in ber, the application of NAA 30 ppm and GA_3 proved to be most beneficial. Similar reports of effects of NAA and GA_3 in reducing stone size in ber have been reported by Bankar and Prasad (1990), Singh and Randhawa (2001) and Bhati and Yadav (2004).

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