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Effect of pruning and plant growth regulators on Physical development of *Ber* tree

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Abstract
Abstract: *Ber* (*Zizyphus mauritiana* Lamk.) is generally consumed fresh and cultivated in several semi-arid areas of Asia because of its adaptability to yield in limiting conditions. The present study aims to assess the effect of different pruning intensity and plant growth regulators on growth parameters and fruiting behavior of *ber* (cultivar Gola). The present study comprised four different pruning intensity of previous season growth *viz.*, P_0 – no pruning, P_1- 25% pruning, P_2- 50% pruning, P_3- 75% pruning and plant growth regulators (PGRs) *viz.*, C_0-Control, C_1- GA_3 @ 10 ppm and C_2- NAA @10 ppm. This study effectively demonstrated that the maximum plant height and plant spread achieved by employing 75% pruning + GA_3 10ppm (P_3C_1). The highest num*ber* of sprouted shoots per branch and shoot length have been obtained by 75% pruning + GA_3 10 ppm (P_3C_1) closely followed by 75% pruning + NAA 10ppm and lowest being in un-pruned shoots + water spray. Early flower initiation was observed with un-pruned shoots (control) as compared to pruned shoots and similar observations have been recorded in case of 50% flowering. Significantly maximum num*ber* of fruit set (60.14%) and fruit retention (43.80%) were recorded with 50% pruning + GA_3 10 ppm (C_1) followed by 50% pruning + NAA 10 ppm (P_2C_2).

Keywords: *Ber*, pruning, PGRs

Introduction
Ber (*Zizyphus mauritiana* Lamk.) is an ancient fruit tree of India and China. It belongs to family Rhamnaceae and is probably native to India. It is known for its ability to withstand adverse conditions. *Ber* is also known as Chinese date or Chinese fig or plum, king of arid fruit and commonly considered as "poor man's fruit. It is easy to cultivate and require less maintenance. Ripe fruits are eaten fresh and utilized in preparation of jam, jelly, preserve and candy. It is also reported that the Indian *ber* is an important fruit crop grown in tropical, sub-tropical and arid regions of the world. It can be grown even on marginal soils and under various kinds of waste land situations such as sodic soil, saline soil, ravines, arid and semi-arid regions including plateau area of Bundelkhand and Southern India. The ripe *Ber* fruits have high nutritive values and it is richer than apple in protein, phosphorus, calcium and vitamin 'C' and one hundred grams of edible *ber* fruits contains moisture (85.9%), protein (0.8 g), fat (0.1 g), carbohydrate (12.88%), calcium (0.03 g), phosphorus (0.03 g), iron (0.8 g), carotene (70 IU) and vitamin 'C' (50-100 mg).
Pruning is an essential operation to maintain Vigour of trees, fruit productivity and yield of *ber* (Singh *et al*., 2004) [15]. Pruning is dependent on the plant height and the canopy spreads. Pruning is required to build strong architecture of branches to bear heavy load of fruits. The objective of pruning is to produce a greater num*ber* of fruits with high quality marketable fruits at a low cost. Apart from these, pruning also lead to rejuvenation, better ventilation, higher penetration of sun light and also become feasible in application of plant protection chemicals (Bakshi *et al*., 1997) [16].
The *ber* fruits borne in the axil of leaves on the young growing shoots of the current year. Hence, a regular annual pruning is necessary to induce a good healthy growth which will provide maximum fruit bearing on the tree. Therefore, it is very much essential to ascertain the extent of pruning in particular cultivars. The foliar feeding of fruit tree has gained much importance in recent years for plant growth regulators' application.

The beneficial effects of foliar application of plant growth regulators is based on the fact that it reach directly to leaves which are the site of metabolism in the plants.

Materials and Methods

The experiment was carried out at Main Experimental Station, Department of Fruit Science, College of Horticulture, A.N.D.U.A. &T, Narendra Nagar (Kumarganj), Ayodhya (U.P.) during the year 2015-2016. The experiment was laid out in Factorial Randomized Block Design with 12 treatments and 3 replications. The pruning times were: P_0: no pruning of previous season growth; P_1: 25% pruning of previous season growth; P_2: 50% pruning of previous season growth; P_3: 75% pruning of previous season growth and the pruning was done on one year old shoots in the 3rd week of May with the help of secateurs. The treatment plant growth regulators were; C_0: water spray (control), C_1: GA_3- 10 ppm, C_2- NAA- 10ppm.The solutions were prepared as per concentrations of plant growth regulators (GA_3 and NAA). The required quantity of chemicals were weighed and dissolved in distilled water and absolute alcohol in measuring cylinder, respectively. The dissolved solutions were diluted and volume made up to 10 liters in plastic buckets as per required quantity of solutions.

Spread of the plant was recorded at East-West and North-South direction with the help of measuring tape and the mean value was computed. Shoots per branch four scaffold branches each in East, West, North and South direction were selected for all replication. Vegetative growth (Shoots) was monitored by counting the num*ber* of shoots at the different growth stages starting from the last week of June. New vegetative shoots on each branch in all the four directions i.e. East, West, North and South were tagged at each vegetative flush data. Tagged shoots were observed to note as to when the inflorescence (axillary cyme) emerges on shoot on a branch, time and date of appearance of first inflorescence in each replication of the different treatments was recorded. Fruit set per cent was estimated in natural conditions, 100 flowers were tagged in each directions of tree (i.e. East, West, North and South) at the time of flowering. Initial fruit set was recorded after 10 days of fruit setting. Per cent initial fruit set was calculated using following formula:

$$\text{Fruit set (\%)} = \frac{\text{Number of initial fruit set}}{\text{Number of flowers tagged at initial stage}} \times 100$$

Fruit retention had calculated with num*ber* of flowers retained in form of fruits was recorded at the time of fruit harvesting and per cent value was worked out as follows:

$$\text{Fruit retention (\%)} = \frac{\text{Number of fruit retained upto harvesting stage}}{\text{Number of fruit set at initial stage}} \times 100$$

Results and Discussions

Effect of pruning intensity and plant growth regulators on plant growth parameters

It is clear from the experiment that Plant growth regulators helped in increasing the vegetative growth of plant. Tree canopy or vegetative growth characters of *ber* (cv. Gola) *viz*., plant height, plant spread, num*ber* of sprouted shoots per branch and shoot length were significantly influenced by employing various pruning intensities with application of plant growth regulators (GA_3 10 ppm and NAA 10 ppm). Maximum plant height and plant spread, num*ber* of sprouted shoots per branch and higher shoot length (312.22 cm) have been achieved by 75% pruning intensity+ 10ppm GA_3 which were significantly superior over un-pruned tree (Control), similar observation were reported by Singh *et al*. (1978). The present results are also in conformity with earlier workers (Chovatia, 1991 and Kundu, 1994) [3, 9].

Effect of pruning intensity and plant growth regulators on flowering and fruiting behaviour and yield parameters

A perusal from the data presented in table-3 showed that days taken to flower initiation and days taken to 50% flowering were affected significantly by various pruning intensities. However, in un-pruned (control) shoot, flower initiation started 2-4 days earlier than 25%, 50% and 75% pruning intensity. Similar findings were also advocated by Lal and Prasad (1980) [10]. Maximum fruit set (60.14%) and fruit retention (43.80%) in the treatment 50% pruning intensity + 10 ppm GA_3 which was significantly superior over rent of the treatments. This might be due to proper balance of nutrients and metabolites needed for fruit setting and ultimately fruit retention because of more open tree canopy allowing more light penetration which led assimilation of more photosynthetic materials in pruned shoots. The present findings are in agreement with Lal and Prasad (1980) [10], Dhaliwal and Sandhu (1982) [4], who advocated higher fruit set (%) and fruit retention (%) in *ber* crop due to pruning and plant growth regulators. Khan and Syamal (2004) [8] reported that in Kagzi lime, moderate pruning gave good result. Kale *et al.* (2004) [6] reported that foliar spray with GA_3 and NAA 10 ppm and 20 ppm increases fruit size in *ber*. Significantly higher fruit weight (23.69 g) was recorded with 75% pruning intensity + application of 10ppm NAA as compared to 75% pruning intensity + 10ppm GA_3 and control, which might be due to higher nutrients availability to the fruits. The similar results were reported by earlier workers Bajwa and Sarowa (1977) [1], Gupta and Singh (1977) [5], and Singh *et al.* (2007) [11]. They advocated that maximum fruit weight was obtained with 8th bud retention when pruning employed in *ber* fruit crop with application of GA_3.

Table 1: Effect of pruning intensity and plant growth regulators on plant height (m) and plant spread (m) of *ber* cv. Gola.

Plant Growth Regulators	Pruning intensity									
	Plant Height					Plant Spread				
	0% (P_0)	25% (P_1)	50% (P_2)	75% (P_3)	Mean	0% (P_0)	25% (P_1)	50% (P_2)	75% (P_3)	Mean
C_0 (Water)	4.51	4.24	4.25	4.39	4.10	3.50	4.81	4.91	5.22	4.86
C_1 (GA_3 10 ppm)	4.70	4.37	4.53	4.60	4.25	3.51	4.98	5.27	5.55	5.13
C_2 (NAA 10 ppm)	4.61	4.30	4.40	4.59	4.21	3.52	5.11	5.28	5.36	5.09
Mean	4.60	4.27	4.33	4.50	4.15	3.51	4.90	5.09	5.39	4.99
	A	B	A x B			A	B	A x B		
SEm±	0.013	0.008	0.016			0.009	0.012	0.023		
CD at 5%	0.039	0.023	0.045			0.026	0.034	0.067		

Table 2: Effect of pruning intensity and plant growth regulators on sprouted shoots/branch and shoot length (cm) of *ber* fruit cv. Gola.

Plant Growth Regulators	Pruning intensity									
	Sprouted shoots/ branch					Shoot length				
	0% (P_0)	25% (P_1)	50% (P_2)	75% (P_3)	Mean	0% (P_0)	25% (P_1)	50% (P_2)	75% (P_3)	Mean
C_0 (Water)	4.24	5.23	5.34	5.57	5.10	257.96	266.79	268.27	281.26	268.57
C_1 (GA_3 10 ppm)	4.29	5.40	6.47	6.57	5.69	262.17	280.96	306.27	312.22	289.99
C_2 (NAA 10 ppm)	4.32	5.41	5.61	6.51	5.48	264.17	271.86	282.25	310.58	282.63
Mean	4.28	5.32	5.48	6.07	5.29	261.06	269.33	275.26	296.74	275.60
	A	B	A x B			A	B	A x B		
SEm±	0.009	0.008	0.016			1.270	1.100	2.200		
CD at 5%	0.027	0.023	0.047			3.678	3.186	6.371		

Table 3: Effect of pruning intensity and plant growth regulators on days taken to flower initiation and 50% flowering of *ber* cv. Gola.

Plant Growth Regulators	Pruning intensity									
	Days taken to flower initiation					50% Flowering				
	0% (P_0)	25% (P_1)	50% (P_2)	75% (P_3)	Mean	0% (P_0)	25% (P_1)	50% (P_2)	75% (P_3)	Mean
C_0 (Water)	90.95	92.98	94.57	94.43	93.23	114.11	117.23	118.45	118.42	117.05
C_1 (GA_3 10 ppm)	91.35	93.67	95.93	95.70	94.16	114.35	117.40	121.45	121.21	118.60
C_2 (NAA 10 ppm)	91.16	93.22	95.80	94.89	93.77	114.27	117.33	121.31	118.54	117.86
Mean	91.15	93.33	95.25	95.07	93.70	114.23	117.32	119.95	119.82	117.83
	A	B	A x B			A	B	A x B		
SEm±	0.025	0.022	0.043			0.016	0.014	0.027		
CD at 5%	0.072	0.063	0.125			0.046	0.040	0.080		

Table 4: Effect of pruning intensity and plant growth regulators on fruit set (%) and per cent fruit retention of *ber* fruit cv. Gola.

Plant Growth Regulators	Pruning intensity									
	Fruit set (%)					Fruit retention				
	0% (P_0)	25% (P_1)	50% (P_2)	75% (P_3)	Mean	0% (P_0)	25% (P_1)	50% (P_2)	75% (P_3)	Mean
C_0 (Water)	46.92	49.18	55.26	54.05	51.35	31.12	36.24	39.98	39.61	36.74
C_1 (GA_3 10 ppm)	48.37	53.60	60.14	57.65	54.94	33.04	38.43	43.80	42.85	39.53
C_2 (NAA 10 ppm)	47.49	52.25	58.22	55.88	53.46	31.71	38.36	43.38	40.11	38.39
Mean	47.65	51.39	57.70	55.85	53.15	32.08	37.34	41.89	41.23	38.13
	A	B	A x B			A	B	A x B		
SEm±	0.061	0.052	0.105			0.060	0.052	0.104		
CD at 5%	0.175	0.152	0.304			0.174	0.151	0.302		

Conclusion

The experiment on the effect of pruning intensity and plant growth regulators on *ber* (cv. Gola) plants revealed significant impacts on various growth parameters, flowering, fruiting behavior, and yield. Here are the key findings:

Plant Growth Parameter

- Plant growth regulators, specifically GA_3 (10 ppm) and NAA (10 ppm), were instrumental in enhancing vegetative growth.
- The combination of 75% pruning intensity with 10 ppm GA_3 resulted in maximum plant height, plant spread, number of sprouted shoots per branch, and shoot length, surpassing un-pruned trees and aligning with previous studies.

Flowering and Fruiting Behavior

- Pruning intensities affected the days taken to flower initiation and 50% flowering, with un-pruned shoots initiating flowering earlier than pruned ones.
- The treatment of 50% pruning intensity with 10 ppm GA_3 showed superior fruit set (60.14%) and fruit retention (43.80%) compared to other treatments.
- Proper nutrient balance and increased light penetration due to pruning likely contributed to higher fruit set and retention, in line with previous research.

Yield Parameters

- 75% pruning intensity with 10 ppm NAA resulted in significantly higher fruit weight (23.69 g) compared to other treatments, possibly due to increased nutrient availability to the fruits.

Overall, the results indicate that judicious pruning combined with appropriate plant growth regulators can substantially enhance the growth, flowering, and fruiting characteristics of *ber* (cv. Gola) plants. These findings support the importance of tailored pruning practices and the strategic use of plant growth regulators for optimal yield in *ber* cultivation. Further research in this area can delve into the specific mechanisms behind these effects and fine-tune recommendations for growers.

References

1. Bajawa MS, Sarowa PS. Pruning in *ber* (*Zizyphus mauritana* Lamk.)-A Review. Punjab Hort J. 1977;17:52-53.
2. Bal JS, Singh SN, Randhava JS, Jowanda JS. Effect of growth regulators on fruit drops size and quality of *ber* (*Zizyphus mauritiana* Lamk.) Ind J Hort. 1984;41(3-4):184-185.
3. Chovatia RS. Pruning in *ber* (*Zizyphus mauritiana* Lamk.)- A Review. Ann Arid Zone. 1991;30(4):353-356.
4. Dhaliwal HS, Sandhu IPS. Effect of pruning on vegetative growth, flowering and fruit set in *ber*

(*Zizyphus mauritiana* Lamk.) cv. Umran. Haryana J Hort Sci. 1982;11(3-4):208-212.
5. Gupta MR, Singh S. Effect of prunig on growth, yield and fruit quality in *ber*. Punjab Hort J. 1977;17(1-2):54-57.
6. Kale VS, Dod VH, Adapawar RM, Bharad SG. Effect of plant growth regulators on fruit charecters and quality of *ber* (*Zizyphus mauritiana* Lamk.). Crop Res Hissar. 2004;20(2):327-333.
7. Korwar GR, Pratibha G, Ravi V, Palinikumar D. Influence of organic and in-organics on growth, yield of Aonla (*Emblica officinalis*) and soil quality in semiarid tropics. Indian J Agric Sci. 2006;76:457-461.
8. Khan M, Syamal MM. Effect of pruning intensity on flowering and fruiting of Kagzi lime (*Citrus aurantifolia* Swingle) Indian J Hort. 2004;61(2):171-172.
9. Kundu SS. Pruning in *ber* (*Zizyphus mauritiana* Lamk.)-A Review. Annu Arid Zone. 1994;3(1):49-52.
10. Lal H, Prasad A. Effect of pruning on rate of fruit growth, extent of fruit drop and maturity in *ber* cv. Pewondi. Prog Hort. 1980;12(1):33-41.
11. Singh JK, Prasad J, Singh HK. Effect of micro-nutrients and plant growth regulators on yield and physico-chemical characteristics of aonla fruits in cv. Narendra Aonla-10. Indian J Hort. 2007;64(2):216-218.
12. Syamal M, Rajput C. Effect of Pruning on Growth, Fruiting and Fruit Quality of *Ber* (*Zizyphus mauritiana* Lam.). Indian J Hortic. 1989;46:364–367.
13. Khan M, Syamal MM. Effect of pruning intensity on flowering and fruiting of Kagzi lime (*Citrus aurantifolia* Swingle) Indian J Hort. 2004;61(2):171-172.
14. Gill KS, Bal JS. Influence of pruning severity and time on yield and fruit quality of *Ber* (*Zizyphus mauritiana* Lamk.) cv. Umran. Indian J Hort. 2006;63(2):162-165.
15. Singh KP, Malik A, Mohan D, Sinha S. Multivariate statistical techniques for the evaluation of spatial and temporal variations in water quality of Gomti River (India)-a case study. Water research. 2004 Nov 1;38(18):3980-92.
16. Bakshi G, Cao C, Chen Z. Empirical performance of alternative option pricing models. The Journal of finance. 1997 Dec;52(5):2003-49.