Response of time and severity of pruning on vegetative and reproductive characteristics of Ber cv. BAU Kul

(Kindly do the correction as earmarked in red color)

ABSTRACT

An investigation was undertaken at Bidhan Chandra Krishi Viswavidyalaya's Horticultural Research Station, West Bengal during 2019-20 to observe the impact of time as well as severity of pruning on plant growth, flowering and fruiting of ber cv. BAU kul. The experiment consisted of eight treatments and three replications; heading back on 1st week of March at 0.5m height as well as at 1.0m height, heading back on 3rd week of March at 0.5m height as well as at 1.0 m height, heading back on 1st week of April at 0.5m height as well as at 1.0m height, heading back on 3rd week of April at 0.5m height as well as at 1.0m height. Pruning in April both at 0.5m and 1.0 m resulted higher fruit yield, shoot length, canopy spread than heading back at March which concluded that heading back done in April both at 0.5m and 1.0m height in ber proved superior.

Keywords: BAU Kul, Flowering & fruiting, Plant growth characters, Pruning

Introduction

Ber (*Zizyphusmauritiana* Lamk.) is most likely indigenous to India, often referred to as "poor man's fruit" and goes by the names Chinese date, fig or plum. Ber is a significant but tiny Indian fruit that is reportedly also produced in Iran, Syria, Australia, the United States, France, some regions of Italy, Spain and Africa. Additionally, according to reports, Indian ber is a significant fruit crop cultivated in arid, subtropical as well as tropical climates around the world.It can be produced in a variety of waste land conditions, including arid and semi-arid locations like the plateau in Bundelkhand and Southern India, as well as on marginal soils and in circumstances with salty or sodic soil, ravines and other types of waste land. The growing popularity of ber cultivation in India's arid and semi-arid regions can be attributed to its cheap maintenance costs, broad adaptability, less water demand, profitable yield, strong returns, potential for value addition and compatibility even under wastelands (Martinuzzo, 2006).Ber fruits that are fully ripe have great nutritional qualities and are more abundant in protein, phosphate, calcium and vitamin-C than apples. Ber fruits that are edible have a moisture content of 85.9%, protein content of 0.8%, fat content of 0.1%, carbohydrate content of 12.88%, iron content of 0.8%and vitamin-C content of 50-100 mg/100 g of pulp. Ber trees are recognised to offer medicinal benefits in addition to producing the nutritious fruits. In order to improve fruit quality and increase crop yield, pruning is a fundamental tool for modifying the architecture of fruit trees and ensuring that they receive the right amount of sunlight as well as temperature. Maintaining the health of trees, fruit productivity and yield in ber

requires regular pruning (Singh *et al.*, 2004). The time and intensity of pruning determine the vegetative growth as well as fruit yield and quality (Kumar *et al*., 2014). An ideal tree canopy encourages early flowering and fruiting while advancing bud sprouting. Normally, after crop harvest, during the summer months when trees are shedding their leaves prior to the commencement of new growth, ber plants are pruned. In West Bengal, ber is grown well in dry and lateritic tracts. But presently with the introduction of BAU Kul, it is growing well in new alluvial zone of West Bengal where humid climate prevails. Ber tree pruning is a highly recommended practise because the fruits are produced on the leaf axils of new branches that have emerged during current season. Flowers are only found on its secondary and tertiary branches, which are its first and second order sylleptic branches (Reddy, 1983). On a healthy shoot, it's important to encourage the growth of the greatest number of secondary and tertiary branches. On any pruned branch, about 98% of the fruits are borne on healthy shoots (Kurian, 1985). But, the time and severity in ber in new alluvial zone has not been standardized yet. Considering these, the current research work was undertaken to find out the response of time of pruning in ber as well as to find out the response of severity of pruning in ber.

MATERIALS AND METHODS:

The research work was carried out at Bidhan Chandra Krishi Viswavidyalaya's Horticultural Research Station, Mondouri, West Bengal during the year 2019-20. These trees were ten years old and a Randomised Block Design (RBD) was used to set up the experiment and it was replicated thrice with eight treatments such as T_1: Heading back on 1stweek of March at 0.5m height, T_2: Heading back on 1stweek of March at 1.0m height, T_3: Heading back on 3rdweek of March at 0.5m height, T_4: Heading back on 3rdweek of March at 1.0 m height, T_5: Heading back on 1stweek of April at 0.5m height, T_6: Heading back on 1st week of April at 1.0m height, T_7: Heading back on 3rdweek of April at 0.5m height, T_8: Heading back on 3rdweek of April at 1.0m height.

Plants were manured and fertilized just after pruning *i.e.*, in the month of April and May depending upon treatments. Both organic manures and inorganic fertilizers were utilised in a ring 60 cm distant from the stem, at a depth of 15-20 cm. Irrigation was given after fertilizer application and at fruit developmental periods. To check the infestation of insects on newly emerged shoots, foliage and young fruits, imidachloprid (1ml/3litre of water) and chlorpyriphos were sprayed alternately as and when required. Various pathogens on the plants are controlled time to time by spraying with bavistin as well as mancozeb (1g/litre of water).

Fruit length and diameter were measured by digital Vernier Calipers. Fruit weight as well as seed weight were calculated by using (digital) electronic balance. Pulp weight was measured by deducting seed weight from the fruit weight.

Fruits' TSS content was calculated by utilising hand Refractometer and titratable acidity of the fruit juice was determined using the procedure described in A.O.A.C., 2000.

The collected data were statistically examined using the analysis of variance method, as recommended by Panse and Sukhatme (1985); the significance of various sources of variation was assessed using the error mean square test by Fisher's 'F' test at a probability level of 0.05 percent.

RESULTS AND DISCUSSION

Trees that were pruned in March1stweek (T_1 and T_2) emerged shoot in the month of March-April. Shoot emergence was in the month of April when the trees are headed back in 3rdweek of March (T_3 and T_4). But trees pruned 1stand 3rdweek of April (T_5, T_6, T_7 and T_8) produce new shoots in the month of April-May (Table 3). As evidenced by the data in Table 1 indicated that plants pruned in 3rdweek of April (T_7 and T_8) took least time for shoot emergence (17.3-19.3 days) irrespective of pruning height. Pruning *i.e.*, heading back in the month of 1stweek of March resulted maximum duration of period for shoot emergence (31.0 days) when pruned at 1.0 m height (T_2). From the current study, it is clear that pruning in 3rd week of April resulted less time for emergence of new shoot but pruning in 1st week March requires more time. It may be due to prevailing of low temperature in 1st week of March. In 3rd week of April, temperature is high that favours the emergence of new shoot after pruning or heading back. Singh and Bal (2008) reported similar findings and recommended pruning from the final week of April to the second fortnight of May. Additionally, this current conclusion supports earlier research by Boora and Singh (2007) in cv. Sanaur-2.

As evidenced by the data in Table 2 indicated that shoot length was found highest after 15 days of pruning when they are pruned in April 1stweek at 0.5 m height (20.34 cm) while heading back in April 3rdweek at 1.0 m height resulted lowest shoot length (13.84cm). Maximum shoot length (49.00 cm) at 30 days after shoot emergence was obtained in the treatment T_5 followed by T_4 (41.34 cm). Heading back in April 1stweek at 0.5 m height (T_5) resulted maximum (85.00 cm) shoot length and T_2 had lowest recorded shoot length (57.00 cm)at 45 days after shoot emergence.

It is evident from Table 3 that T_5 resulted maximum spread of plant (58.67 cm) in East-West direction while T_8 showed minimum spread of plant (26.00 cm) at 60 days after shoot emergence. Heading back in April 1st

week at 0.5 m height (T_5) recorded maximum spread of plant (51.00 cm) whereas heading back in April 3rd week at 1.0 m height (T_8) recorded minimum spread of plant (23.34 cm) in North-South direction at 60 days after shoot emergence.

As evidenced by the data in Table 4 indicated that T_5 produced maximum no. of primary shoots (31.34) whereas T_1 recorded lowest no. (18.34) before thinning at 30 days. Maximum number of branches (7.08) in a primary shoot was obtained with treatment T_7 while it was minimum (5.15) with treatment T_4 at 60 days after shoot emergence.(Kindly provide whole number examples if 31.34 means , you can put 31 like that)

Trees which were pruned or heading back in March 1st week at 0.5 m height (T_1) showed early flower bud emergence (21.08.19-24.08.19). As evidenced by the data in Table 5 indicated that trees pruned in March 1st week took higher period of time both at 0.5 m height (168.67 days) and 1.0 m height (174.34 days). T_7 took less days (137.34 days) from pruning to flower bud emergence than any other treatments. It is clear that trees which were pruned in April generally required less period from pruning to flower bud emergence than trees pruned in March. All the treated plants flowered in the month of September. In comparison to April pruning, trees that were pruned in March flowered earlier, irrespective of height. It is evident from Table 5 that treatment T_1 and T_2 took more period of time from pruning to flowering (189.34 and 193.67 days, respectively) as compared to treatment T_7 and T_8 (157.67 and 162.67 days, respectively). Fruit set was early when the trees were pruned in March (02.10.19-06.10.19) irrespective of height of pruning as compared to trees pruned in April (09.10.19-18.10.19). T_2 took maximum period of time (211.34 days) from pruning to fruit set while T_7 took minimum period of time (178.67 days). This is quite possible as early pruning results early initiation of shoot that lead to early flowing and fruit set. According to Sharma and Banyal (2020), the timing of pruning had a substantial impact on a number of flowering and fruiting parameters.(Kindly put whole number like 178 days instead of 178.67 days)

The maximum fruit weight (49.34 g) was observed with treatment T_4 and it was lowest (41.0 g) with treatment T_5 as well as treatment T_7. Heading back at 1.0 m height showed higher fruit weight than heading back at 0.5 m height irrespective of pruning time. T_4 resulted highest amount of pulp weight (45.30 g) while T_5 showed the lowest amount (37.42 g). As evidenced by the data in Table 6 indicated that T_2 resulted highest fruit length (4.14 cm) whereas T_5 produced lowest fruit length (3.67 cm). Heading back in March 1st week at 0.5 m height (T_1) showed highest fruit diameter (4.14 cm) while heading back in April 1st week at 0.5 m height (T_5) showed lowest fruit diameter (3.84 cm). The data of yield presented in Table 6 showed that T_8 resulted

maximum yield (45.7 kg/plant) and T_1 recorded minimum fruit yield (26.4 kg/plant). In the present study, the variation of fruit weight, pulp and seed weight as well as fruit size was inconsistent among different treatments. However, pruning in March resulted bigger sized fruits with higher weight as compared to the trees that were pruned in April. Boora and Singh (2007) also obtained big sized fruits with pruning between 15-30th March by retaining 8 buds in ber cv. Sanaur-2. Pruning in the month of April both at 0.5 m and 1.0 m height resulted higher fruit yield than pruning at March. Pruning in April does not affect fruit weight or pulp weight; instead, it increases fruit yield. It may be due to higher increase in shoot growth. In contrast, Boora and Singh (2007) obtained higher fruit yield when pruning was done between 15-30th March. Choudhary *et al.* (2020) also observed higher yield of custard apple in terms of time interval and pruning intensities.

Treatment T_1 exhibited maximum TSS content in fruits (13.84°Brix) and treatment T_6 produced fruits with minimum (12.47°Brix) TSS content. Jawadagi*et al.* (2001) also found higher TSS content when plants were pruned on 30th March. As evidenced by the data in Table 7 indicated that T_8 recorded maximum titratable acidity (0.27%) while T_4 and T_1 both recorded lowest titratable acidity (0.20%). Maximum TSS/acid ratio (76.37) was observed in the plants treated with treatment T_3 whereas T_6 recorded minimum of TSS/acid ratio in fruits (49.87).

Conclusion:

In the present investigation, ber plants were pruned at a height of 0.5 m and 1.0 m in months of March as well as April. The plants were headed back on 1st and 3rd week of each month; in this way eight different pruning treatments were observed. Based on the results of the above experiment, Pruning in 3rd week of April resulted less time for emergence of new shoot; the increase of shoot length, spread of plant, primary and secondary branches were found higher in month of April. Date of emergence of flower bud, initiation of flowering and fruit set was early in plants that were headed back in the month of March, but period of pruning to flower bud initiation, pruning to flower initiation and pruning to fruit set initiation was less in plants that were headed back in the month of April. Pruning in the month of April both at 0.5 m and 1.0 m height resulted higher fruit yield than pruning in March. Based on emergence of new shoots, increase of shoot length and fruit yield, finally it can be concluded that pruning or heading back in the month of April both at 0.5 m and 1.0 m height in ber proved superior.

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Table 1 :Impact of time and severity of pruning in ber on shoot emergence (days kindly write in whole number)

Treatment	Date of pruning	Date of shoot emergence	Period required for shoot emergence (Days)
T1	1st week, March	27.03.19 - 09.04.19	26.3
T2	1st week, March	05.04.19 – 18.04.19	31.0
T3	3rd week, March	07.04.19 – 10.04.19	21.3
T4	3rd week, March	06.04.19 – 08.04.19	20.7
T5	1st week, April	30.04.19 – 02.05.19	26.7
T6	1st week, April	25.04.19 – 08.05.19	28.0
T7	3rd week, April	29.04.19 – 10.05.19	17.3
T8	3rd week, April	02.05.19 – 10.05.19	19.3
SEm±	-	-	7.47
CD(p≤0.05)	-	-	2.44

Table 2 :Impact of time and severity of pruning in ber on shoot growth

Treatment	Shoot length at 15 DASE (cm)	30 DASE		45 DASE	
		Shoot length (cm)	Increase (%)	Shoot length (cm)	Increase (%)
T1	18.34	37.67	230.75 (14.94)	66.67	176.27 (13.28)
T2	18.34	38.34	213.34 (14.56)	57.00	162.49 (12.67)
T3	15.84	28.34	176.65 (13.24)	60.00	205.67 (14.36)
T4	16.67	41.34	254.82 (15.91)	76.00	185.81 (13.66)
T5	20.34	49.00	240.52 (15.46)	85.00	180.69 (13.42)
T6	14.67	36.00	244.27 (15.60)	76.00	213.99 (14.61)
T7	16.34	30.67	185.86 (13.67)	70.00	252.38 (15.61)

T8	13.84	31.34	240.91 (15.47)	68.34	217.42 (14.76)
SEm±	2.60	6.78	36.17	11.30	34.90
CD(p≤0.05)	N. S.	N. S.	N. S.	N. S.	N. S.

DASE: Days after shoot emergence; N. S.: Non-significant

Table 3: Impact of time and severity of pruning in ber on plant spread at 60 DASE

Treatment	East-West(cm)	North-South(cm)
T1	34.00	29.67
T2	44.00	36.34
T3	33.34	27.34
T4	39.00	39.00
T5	58.67	51.00
T6	38.34	40.34
T7	28.34	26.00
T8	26.00	23.34
SEm±	17.03	6.68
CD(p≤0.05)	5.56	N.S.

N. S.: Non-significant

Table 4: Impact of time and severity of pruning in ber on no. of shoots and no. of branches

Treatment	No. of primary shoots before thinning at 30 DASE	No. of branches in a primary shoot at 60 DASE
T1	18.34	7.00
T2	22.34	6.17
T3	22.34	5.78
T4	28.34	5.15
T5	31.34	6.95
T6	23.67	6.25
T7	21.34	7.08

T8	22.67	6.28
SEm±	2.81	0.53
CD(p≤0.05)	N. S.	N. S.

N. S.: Non-significant

Table 5 : Impact of time and severity of pruning in ber on flowering and fruit set(Days should be listed as whole number)

Treatment	Date of initial flower bud emergence	Period from pruning to flower bud emergence (Days)	Date of initial flowering	Period from pruning to flowering (Days)	Date of initial fruit set	Period from pruning to fruit set (Days)
T1	21.08.19 - 24.08.19	168.67	11.09.19 - 14.09.19	189.34	02.10.19 - 04.10.19	210.34
T2	27.08.19 - 29.08.19	174.34	16.09.19 - 18.09.19	193.67	03.10.19 - 06.10.19	211.34
T3	24.08.19 - 26.08.19	159.67	14.09.19 - 16.09.19	180.67	02.10.19 - 04.10.19	199.34
T4	22.08.19 - 24.08.19	157.67	10.09.19 - 12.09.19	177.67	01.10.19 - 03.10.19	198.00
T5	02.09.19 – 04.09.19	151.67	22.09.19 - 25.09.19	172.00	10.10.19 - 12.10.19	190.34
T6	29.08.19 – 06.09.19	151.34	17.09.19 - 27.09.19	172.00	13.10.19 - 15.10.19	193.34
T7	29.08.19 – 06.09.19	137.34	17.09.19 - 29.09.19	157.67	09.10.19 - 18.10.19	178.67
T8	05.09.19 – 07.09.19	140.67	25.09.19 - 29.09.19	162.67	12.10.19 - 18.10.19	180.00
SEm±	-	3.94	-	5.81	-	4.28
CD (p≤0.05)	-	1.29	-	1.90	-	1.40

Table 6: Impact of time and severity of pruning in ber on fruit physical characters

Treatment	Fruit weight (g)	Pulp weight (g)	Seed weight (g)	Fruit length (cm)	Fruit diameter (cm)	Yield (kg/plant)
T1	45.67	41.74	3.92	4.00	4.14	26.4

T2	48.34	44.34	4.00	4.14	4.07	27.6
T3	44.34	43.84	3.83	3.80	3.90	32.7
T4	49.34	45.30	4.04	4.04	4.10	34.2
T5	41.00	37.42	3.58	3.67	3.84	36.9
T6	45.67	41.78	3.89	4.07	4.07	39.1
T7	41.00	37.45	3.56	3.87	3.94	42.3
T8	46.34	42.50	3.84	4.04	4.10	45.7
SEm±	2.69	2.47	0.20	0.19	1.40	3.072
CD(p≤0.05)	N. S.	N. S.	N. S.	N. S.	N. S.	7.833

N. S.: Non-significant

Table 7: Impact of time and severity of pruning in ber on fruit quality

Treatment	**TSS (°Brix)**	**Titratable Acidity (%)**	**TSS/Acid ratio**
T1	13.84	0.20	72.77
T2	13.34	0.24	58.50
T3	13.37	0.22	76.37
T4	13.10	0.20	65.50
T5	13.24	0.24	57.14
T6	12.47	0.25	49.87
T7	13.74	0.25	61.54
T8	13.50	0.27	58.10
SEm±	0.65	0.04	12.70
CD(p≤0.05)	N. S.	N. S.	N. S.

NS: Non-significant