PRUNING IN BER (ZIZIPHUS MAURITIANA LAMK) - A REVIEW

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ABSTRACT

Pruning of the ber (Ziziphus mauritiana Lamk) tree is highly desirable practice as fruit is borne in the axils of leaves of young shoots developed during current season. The work carried out by different scientists on effect of severity and time of pruning on vegetative growth, yield and quality of fruits and concluded that pruning in ber should be carried out in the last week of the April to 2nd fortnight of May. The time of the pruning determines the vegetative growth, tree canopy and advances the bud sprouting and induces early flowering and fruiting. Low intensity of pruning improves the fruit yield and quality. Therefore ber should be pruned during summer month after harvest of crop when the trees shed their leaves before onset of the new growth. The early pruning advances bud sprouting and early harvest and improves fruit yield and quality. The deviation in time of pruning from this phase of dormancy results in the lower yield and poor quality fruits. In tropical regions with a mild winter, rainfall during December-January and early onset of summer rainfall (e.g. Tamil Nadu in southern India). Pruning can be carried out any time from January to April and it is also possible to regulate fruit maturity so that bearing occurs at the desired time. In Maharashtra, western India, the best time for pruning is before the end of April.

Ber (Ziziphus mauritiana Lamk.) is cultivated commercially in arid and irrigated parts of Indian subcontinent. This is one of the most ancient fruit crop grown in India. In last two decades area under ber crop is increased and farmers have adopted its commercial cultivation. Practically pruning in fruit crops depends upon its fruit-bearing pattern. In ber crop flowers born in axils of the leaves of current season young shoot (Bal, 1984) therefore among all cultural operations pruning in ber is primarily most important annual operation. In case of unpruned tree canopy area continue to enlarge year after year, branch lets become very weak, fruit size reduced and tree ultimately become unproductive whereas in case of judiciously pruned tree vigor and shape is maintained and fruit size and quality is improved. The works carried out by various scientists on effect of severity and time of pruning on vegetative growth, yield and quality of fruits in order to know exact amount of wood to be pruned at an appropriate time has been reviewed and compiled under different subheads.

Effect of time of pruning on vegetative growth

The time of pruning influences bud sprouting and determine annual vegetative growth of plant. Kundu et al (1994) obtained maximum shoot length, shoot diameter, leaf area by pruning half of the primary branches from base and remaining half to 15 buds on 30th May, he also reported delayed bud sprouting as a result of delayed pruning. Devi and Babu (1993) also reported advancement of bud sprouting. The tree pruned on 14th April produced tallest plant and maximum number of branches per tree. Gupta and Godara (1989) reported that bud-sprouting percentage was not affected by different time of pruning. The annual shoot growth as well as leaf area was found maximum in the 30th May pruning tree.

Singh et al (1978) pruned ber tree at 75 cm from base during last week of June and this resulted in better response in term of shoot growth. Sandhu et al. (1992) the early pruning treatment started from 1st May to middle of June resulted in increased main shoot length than
succeeding treatment. The main shoot length was maximum when pruning was done by 15th May and minimum by 28th July. The main shoot length was at par on all pruning dates till middle of May, whereas it was significantly lower on following dates.

**Effect of time of pruning on fruit yield and quality**

It has been reported by various workers that time of pruning in ber advance the bud sprouting, flowering and improved the fruit yield and quality. (Sandhu *et. al*, 1992) The flower initiation started earlier in treatments where early pruning was done. The initiation of flowering took place by 6th September where pruning was done on 1st May and flower initiation was delayed by 30th September when pruning was done on 28th July. The period of flower initiation was advanced by 24 days in earliest pruned trees. The fruit set was significantly higher on trees pruned on 30th May than those pruned on after 14th June. The lowest fruit set was obtained from trees pruned as late as on 28th July. The final fruit retention was higher in trees pruned on 30th May. However the early pruned trees retained less fruit as compared to late pruned tree. The highest initial fruit set exhausted the trees thus reducing the final retention in early pruned trees. However, the total retention and ultimate yield was higher in early pruned trees than late one.

Singh and sandhu (1984) pruned the ber cv. Umran at fortnightly interval from 15th April to 15th July and reported that early pruning induces early flowering advanced period of blooming by 14 days, initiated more flower/cymes and higher fruit set in trees pruned in May. Fruit on the tree pruned 15th April and 15th July matured on 18th to 28th March respectively. Singh *et al* (1978) carried out pruning of ber during last week of June and reported good fruit size, yield and quality of the fruit. Kundu *et. al* (1994) obtained maximum fruit set and fruit retention by pruning half of primary branches from the base and remaining half to 15 buds on 30th May. They also reported delayed flowering and fruit set as a result of delayed pruning.

Kundu *et. al* (1995) found maximum fruit weight, yield, pulp stone ratio and minimum stone weight in the tree pruned on 30th May. Similarly maximum TSS and ascorbic acid and minimum acidity were recorded in the fruit of those trees that were pruned on 30th May. Devi and Babu (1993) reported that pruning of ber tree in the first fortnight of the April resulted in early harvest because of the advancement of the flowering due to early bud sprouting. The maximum fruit yield was obtained in trees pruned on the 14th April and minimum from those pruned on 15th May. Gupta *et. al* (1990) reported good fruit set and highest fruit retention with moderate pruning on 30th May. The fruit quality in term of TSS, acidity and ascorbic acid did not improved significantly in any pruning treatment. Nijjar (1972) reported that best time for pruning of ber tree is during summer month when trees shed their leaves and new growth has not started yet. Singh *et. al* (2004) found that fruit yield was recorded appreciably higher from plants pruned on 15th April and mean average yield was noted 180.3kg per tree in cv Sanaur-2. The time of pruning has non-significant effect on fruit size, fruit weight and total soluble solids. Saini *et. al* (1994) also reported that total soluble solids in ber fruit were not affected when the trees were pruned on 30th May, however Kundu *et al* (1995) while working on ber under Hisar condition observed the maximum fruit weight and total soluble solids in fruit of tree pruned on 30th May. Sriniwas and Haribabu (1997) reported that time of pruning had significant influence on various parameters of flowering and fruiting. Early pruning advanced the date of flowering with minimum number of days required to come to flowering. Similarly early pruned trees have come to picking early as compared to late pruned trees. Highest yield were obtained from trees pruned on 14th May and concluded that ber tree under south Indian condition i.e. in Andhra Pradesh may be pruned
during the first fortnight of April to obtain good yield. Sandhu et. al (1992) and Kundu et. al (1992) noted the highest yield from the Umran tree pruned on the 30th May. Singh et. al (2004) concluded that pruning in the Sanaur-2 cultivars of the ber should be carried out during the third week of April at eight bud level of the previous year growth give higher yield and better quality fruits.

Sandhu et. al. (1992) reported that fruit yield was highest when the trees were pruned on 30th May. This was followed by the treatments where pruning was done on 15th May. However the yield was significantly decreased as pruning time was extended beyond end of June.

The lowest yield was obtained from trees pruned as late as on 28th July. The ber trees being summer deciduous and are in deep dormancy during May and June and level of reserve metabolites such as carbohydrates starch and sugars is higher during this phase of dormancy. Pruning during this period led to more growth, higher fruit set, greater yield. However pruning done during the induction phase (April) and breaking phase (July) resulted in lower yield. The fruit length diameter and weight were significantly affected by time of pruning. The delayed and reduced growth and less time from flowering to fruit maturation in late pruned trees affect the development of fruit. Thus reducing the size and weight of the fruit in the late pruned trees. In tropical regions with a mild winter, rainfall during December-January and early onset of summer rainfall (e.g. Tamil Nadu in southern India). Pruning can be carried out any time from January to April and it is also possible to regulate fruit maturity so that bearing occurs at the desired time. Pareek and Vishal Nath, (1996). In Maharashtra, western India, the best time for pruning is before the end of April Pareek and Vishal Nath, (1996); Deotate et. al., (1997) as further delay causes reduction in fruit yield.

Effect of intensity of pruning on vegetative growth

Pruning is necessary in ber to maintain productivity of the fruit trees and to improve the quality of fruits. It is therefore a regular yearly practice in well managed orchards in India through the pruning operation, the almost unproductive upper part of the past seasons main shoot and its secondary branches as well as undesirable, weak, crisscrossing deceased and broken branches are removed so that the most healthy and vigorous growth is induced at the most productive nodes. The productivity of the tree is thus maintained because about 98% of the fruit produced on any pruned branches are borne on vigorous shoots and only 2% on the other shoots (Kurian, 1985).

There are various reports based on the experimental evidences that pruning intensity or severity has significant effect on the tree canopy or vegetative growth that ultimately lead to the improvement in fruit yield and quality. Bajwa et. al (1986) reported that the pruned wood weight was highest in severe pruned tree. Growth of the shoots was faster in pruned trees than unpruned trees. Pruning treatment decreased the numbers of the shoots. Awasthi and Mishra (1969) found decreased number of new sprouts as severity increased by pruning branches from 25 to 75cm height. Dhaliwal and Sandhu (1982) reported that not much difference was noted in rate of shoot growth due to different pruning treatment. The unpruned tree produce more number of leaves but leaf area was more under 25cm pruning treatment. Gupta and Singh (1977) reported that there were no significant differences in numbers of the new branches that emerged from cut end. However highest no of the branches were produced by tree under control whereas lowest number of branches were produced by the trees which were given heavy pruning. Different intensities of pruning had
significant effect on length and girth of new branches. The unpruned tree produced highest number of the new branches per tree as compared to pruned tree under different intensities of pruning.

This may be due to reason that there was more branchlet in the unpruned tree for sprouting of the new branches as compared to pruned tree. Similar results are reported by Awasthi and Misra (1969) who observed that unpruned ber trees produced the maximum no of shoots and put forth the maximum tree growth as compared to pruned trees. All the pruning treatments showed significant differences in increasing the length and girth of the new branches over control. Lal and Godara (1985) reported that percentage of bud sprouting significantly increased with heavy pruning.

Shoot length and diameter also appreciably increased with heavy pruning along with maximum leaf area. Faster shoot growth was recorded in pruned tree. Chovatia et al (1991) revealed that pruning at the 4th secondary branches gave higher shoot length in ber cv Gola.

Hiwale and Raturi (1993) revealed that shoot length and shoot diameter increased significantly with increasing severity of pruning. However number of new sprout produced from the pruned branches decreased with increased severity of the branches.

Saini et al (1993) found non-significant effect of various pruning treatment on overall tree height, spread and stock scion girth. Annual shoot length was maximum in 4th secondary treatment. Nanthkumar and Balakrishana (1998) recorded maximum shoot length and highest number of branches per shoot in severe and medium pruning respectively. With regard to cultivars/rootstock Z. rotundifolia has produced longer shoots and more branches per shoot than other two varities Banarsi and Umran.

Pandey et al. (1998) reported that there was no significant effect on length of primary, secondary and tertiary branches. Maximum length of primary branches was observed in unpruned plants and secondary branches under 25% pruning level, which was at par to 50 and 75 percent.

**Effect of intensity of pruning on fruit yield and quality**

There are various reports that intensity of the pruning affect fruit yield and quality. Singh et al (2004) reported that the fruit size in terms of length and breadth increased with severity of pruning and was recorded maximum (4.53cmX3.63cm) from the plants pruned at 8th buds level. The large fruit in heavy pruned trees were due to their less number per tree.

Fruit weight also increased over control as the severity of the pruning was increased. The maximum fruit weight was obtained with 8 buds retention closely followed by 2 buds. The increase in the fruit weight in these treatments was significantly better than 16-buds retention, 25 percent removal and control, which may be due to the higher nutrient availability to the fruits. These results corroborate with finding on ber pruning by other workers (Bajwa and Sarowa (1977) Kundu et al (1995) Pandey et al (1998).

The minimum fruit weight and fruit size was recorded in unpruned tree and in light pruning treatment. The cumulative fruit yield was noted highest from the tree pruned at 16-bud level followed by 8th buds levels. The result revealed that the fruit yield get reduced with severe pruning. Gupta and Singh (1977) and Bajwa et al (1986) also observed that total yield was decreased by severe pruning. It is admitted fact that reduction in the fruit yield is due to reduction in number of the shoots which lead to the less number of fruit per tree as bearing area get reduced. Generally the fruit quality in term of total soluble solids improved as the amount of pruning was increased. The total soluble solids in the fruit were recorded maximum from tree pruned at 8-buds level pruning. Reddy (1983) observed that if the nodes up to the fourth or
sixth secondaries (17-23 nodes) on the main axis are induced to sprout by pruning, vigorous shoots giving maximum fruit yield are produced. Also the new growth arising from the nodes on the main axis is significantly more productive than that emerging from the secondaries.

Saini et al (1994) also reported that TSS in the ber fruit was affected with the different pruning treatment. Kundu (1995) and Bankar et al (2000) observed that pruning also influenced fruit quality in ber. Gupta et al (2000) found early flowering in the branches that were pruned to the 6th secondary.

Dhaliwal and Sandhu (1982) The flowering density and numbers of flowers were significantly higher under control while higher percent of fruit set and fruit retention was obtained under pruning of 75 cm treatments Lal and Prasad (1980) reported that unpruned tree flower 3-6 days earlier but maximum flower production was noticed on those pruned moderately at 90 cm. Kundu et al. (1995) observed the reduced bud sprouting and flowering period as a result of the pruning treatment. Flowering however advanced and the duration of the flowering increased with the severity of the pruning (Saini et al 1993, 1996) Nanthakumar and Balkrishana (1998) reported that the increased level of the severity delayed flowering with increasing levels of the pruning intensity.

Pandey et al (1998) recorded maximum number of the flowers cluster on primary, secondary and tertiary branches under 50 percent pruning intensities. Singh et al (1978) found better fruit quality by pruning at 75 cm with increasing pruning severity from 25 to 75 percent increased the pulp/stone ratio total soluble solids (TSS) and vitamin C content but decreased in the titratable acidity.

Bajwa et al (1988) Symal and Rajput (1989) Sandhu et al (1992) reported significantly higher reducing sugars and non-reducing sugars by pruning at 25cm and 125cm. Pulp stone ratio and total soluble solids were highest at 25cm pruning where as the acidity was least by pruning 125 cm. Yadav and Godara (1987) observed increased TSS and ascorbic acid content with the increasing pruning severity Hiwale and Raturi (1983) recorded highest total soluble solids (26.1 o brix) in the tree pruned at 120 cm of previous season growth where as maximum fruit weight and yield was recorded in pruning 90cm. The increase in fruit weight and higher TSS may be due to increased severity of the pruning which result into a more open tree canopy and this allowing more light and less competition for the growth of individual fruit compared to unpruned tree under semiarid dry condition in North West part of the India. Where as Saini et al (1994 and 1996) reported non-significant effect on the fruit quality. Awasthi and Misra (1969) reported that initial fruit set was higher on heavy pruned plants at 25 cm but the final retention was higher by light pruning at 75 cm resulting larger fruit size. Gupta and Singh (1977) Reported that there were significant differences in average weight and size of the fruits under different pruning treatment average weight per fruit was the highest under medium intensity of pruning and was on at par with light and heavy intensity of pruning. It was lowest under control. Fruit size was significantly larger under heavy pruning and was on a par with medium and light intensities of pruning and was lowest under control. There were no significant differences in yield per tree under different pruning intensities. All pruning treatments were effective in increasing the average weight and size of the fruit as compared with the control.

Awasthi and Mishra (1969) also found similar results. It was evident that the yield of marketable fruit was more in pruned tree as compared to unpruned tree. TSS and acidity were not affected by any pruning intensity. Average fruit weight and size were higher under pruned tree than under control trees. There were
no significant differences in yield under different treatments. However total yield was more under control. The fruit quality was slightly improved under different pruning treatments as compared to control.

Chovatia et al (1991) found that pruning at the 4th secondary branches gave maximum fruit set; fruit weight as well as minimum fruit drop resulting in higher fruit yield. Hiwale and Raturi (1993) recorded higher percentage of the fruit set, retention and yield in tree pruned at 90 cm length. Saini et al (1994) observed early fruit set in 4th and 6th secondary treatment during 1990 and 1991 respectively. Pruning beyond 6th secondary branches produced maximum yield per tree. Kundu et al (1995) found the maximum fruit weight and pulp stone ratio and minimum stone weight in the trees where half the branches were pruned from the base and remaining half to the 15bud on the 30th May. The yield reduced significantly as the pruning severity was advanced and the maximum yield was recorded with medium pruning leaving 75 cm of the secondary shoots from the base.

Pandey et al (1998) reported that there was no marked variation among cultivars with respect to flower clusters on different types of branches. Pruning was significantly effective for increasing the number of flower clusters/primary, secondary and tertiary branches. The maximum numbers of flower clusters on each type of branches were observed under 50% pruning intensity. It was due to that flower production in ber mainly takes place on the secondary and tertiary shoots of optimum vigour. As 50% pruning could induce more number of both types of branches, it could thereby increase the number of flower clusters on all type of shoots. Similar types of results were reported by Awasthi and Mishra (1969). Fruit yield of ber Umran was significantly higher in both Banarsi Karaka and Gola. Pruning treatments proved markedly effectively to improved yield in all the cultivars. However medium pruning of 50% produced highest yield in all the cultivars.

The increased percentage of both setting and retention in all the cultivars with the help of 50% pruning might be responsible for significant improvement in the yield. According to Lal and Prasad (1980) and Dhaliwal and Sandhu (1982) fruit set, fruit retention, growth, development and size of the fruit were increased when ber plant were pruned moderately i.e. 90cm length. Syamal and Rajput (1989) reported that fruit set and retention increased in light pruning treatment than in severely pruned shoots and obtained higher yield by light pruning since fruit set and retention decreased with severity of the pruning. The unpruned and lightly pruned tree produced more fruit this is because of the reduction of shoots in pruned trees whereas fruit quality in terms of the TSS acidity and vitamin C content improved in severely pruned tree hence the quality of the fruit improved due to pruning effects. Gupta et al (1989) observed significantly increased fruit set in 4th-secondary treatment given on 15th May. However maximum fruit retention was recorded in 30th May pruned tree, which were pruned up to 6th secondary.

CONCLUSION

In ber (Ziziphus mauritiana Lamk) fruits are borne in the axils of leaves of young shoots of current season growth, hence pruning of the branches is an important annual operation to increase the fruit yield and quality. The works carried out by various scientists on effect of intensity and time of pruning on growth, yield and quality of fruits, concluded that pruning in ber should be carried out in the last week of the April to 2nd fortnight of May after fruit harvest when trees shed their leaves in northern India. The time of the pruning determines the vegetative growth, tree canopy and advances the bud sprouting and induces early flowering and fruiting. Low intensity of pruning improves the fruit yield and quality. Therefore ber should be pruned during summer month after harvest of crop when the tree shed their leaves before onset of the new growth. The early pruning advances bud sprouting and early harvest and
improves fruit yield and quality. The deviation in time of pruning from this phase of dormancy result in the lower yield and poor quality fruits. In tropical regions with a mild winter, rainfall during December-January and early onset of summer rainfall (e.g. Tamil Nadu in southern India). Pruning can be carried out any time from January to April and it is also possible to regulate fruit maturity so that bearing occurs at the desired time. In Maharashtra, western India, the best time for pruning is before the end of April. In future research work on should be carried out keeping in view these considerations: 1 Yield per unit area - High density planting by tree canopy manipulation through pruning will increase the yield per unit area. ki II Reduction in cost of harvesting - Reduction in cost of harvesting of fruits by low-headed tree through pruning oriented canopy management.

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