



Pruning in Indian Jujube (*Ziziphus mauritiana* Lam.): A Review

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Received: December 2016

Abstract: Pruning in ber is required right from the year of planting. During the pre-bearing stage, it is done to build strong framework to bear the load of fruits and to distribute light and air evenly. In later years, it is done to enhance the yield and quality of fruits every year because; the fruits are borne on current year's growth which is induced by pruning. Pruning time in India is to the specific geographical location. In sub tropical regions, it is done from May to June depending upon latitude while in tropical regions; it can be done from January to April depending upon the possibility of winter rainfall. In western India like in Maharashtra, it should be done before the end of April. Pruning time and intensity affect vegetative growth, flowering, fruiting, fruit drop, fruit retention, fruit maturity time and fruit quality attributes. Light to moderate pruning levels has been found to enhance fruit yield and quality of ber while heavy pruning affects it adversely with delay in fruit maturity owing to more vegetative growth.

Key words: Indian jujube, pruning, pruning intensity.

The Indian jujube (*Ziziphus mauritiana* Lam.), popularly known as ber in India is one of the most important fruits for arid and semi-arid regions of India and other isoclimatic parts of the world. Of late, it has assumed status of commercial fruits due to remunerative income to farmers at low cost of cultivation. It is also cheap source of most of the nutrients and minerals.

Pruning for Form (Training)

Under natural condition, ber has a bushy and spreading growth habit often with long straggly branches and weak crotches. A strong, open and upright frame is required to be achieved by training to obtain higher yield of good quality fruits. This is done in the initial 2-3 years after transplanting of the plants in the field or after budding *in situ*. Under the subtropical condition of India, planting is done in July-August, and the plants are allowed to grow until the following spring (March-April) when it is headed back keeping 1-2 basal buds on the scion portion just above the graft union to induce development of vigorous shoots. One upright growing vigorous shoot is retained from the scion bud (Pareek, 2001). The trunk is kept clean up to a height of 30 cm from ground level by removing all side shoots. Three-four properly spaced and favorably placed branches are allowed to grow from the main trunk. The

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top of the trunk is again headed back during May to encourage growth of side branches. Ber has a character to produce branches usually starting from sixth or ninth node from the base and subsequently at regular intervals of three internodes (Reddy and Chadha, 1993). It is observed that during spring or summer season of the following year, shoots emerges from the basal buds of these second aries and grow vigorously, but the second aries themselves either dry out or remain insignificant in growth and vigour (Pareek, 2001). In the spring of the second year, the second aries are again pruned to basal buds for emergence of vigorous shoots in the next season. One of the shoots emerging from the secondaries is retained, which will form main branches of the tree. On these main branches, 3-4 upright growing and well spaced side shoots are retained and top of such branches are again removed. In the spring of the fourth year, these side shoots are pruned to their basal buds. Vigorous shoots emerge from these buds to form the tertiary branches of the tree architecture.

Pruning

Basically, pruning is an art as well as science. Art because it requires skill, and science because a pruner has to have adequate knowledge and experience regarding the growth habit, flowering, and fruiting behavior of a particular species. During pruning operation,

certain branches are either cut completely or a portion of it is retained to improve plant shape and also to influence its growth, flowering and fruitfulness. Pruning is also essential to improve fruit quality and to repair injury. Sometimes, it is difficult to distinguish training from pruning. The pruning aimed at giving a particular shape or form is referred as training. It determines the general characters and even the details of plant's outlines and its branching patterns, whereas, pruning is meant to contribute more in determining tree's role in fruiting.

Annual pruning is necessary to maintain the plants in productive state and to produce the quality fruits. In Jujube, flowers/fruits are borne on young shoots of current season's growth (Singh *et al.*, 1970) and remains confined to its first and second order sylleptic branches i.e. the secondary and tertiary branches (Reddy, 1983). Pruning should therefore, induce the emergence of maximum number of secondaries and tertiaries on vigorous shoot. This can be achieved when done at the right time with right intensity depending upon the location and cultivar. Pruning invigorate the plants which help in the production of healthy and fruitful branches. Annual pruning is therefore, essential to get maximum fruitful and vigorous shoots in ber. About 98% of fruits produced on any pruned branches are born on vigorous shoots, and only 2% on other shoots (Kurian, 1985). Pruning also opens up the tree form for sunlight, air and ease of chemical spraying. The works carried out by various researchers on effect of severity and time of pruning on vegetative growth, yield and quality of fruits has been reviewed and compiled under different subheads.

Time of Pruning

The time of pruning in ber is region specific. In subtropical regions, the most appropriate time for pruning is during hot and dry summer when plants shed off their leaves and enter in dormancy (Nijjar, 1972; Singh and Sandhu, 1984) but it should be done before the onset of new growth. Under the adverse conditions like in arid region, plant do not put forth new growth unless some good rainfall is received. In tropical region with mild winter and rainfall during December-January and early onset of summer rainfall (e.g. Tamil Nadu, southern India), pruning can be carried out at any

time from January to April with a possibility of regulating fruit maturity at desired time (Pareek and Vishal Nath, 1996). In tropical region with no winter rainfall (e.g. Andhra Pradesh), it is advisable to prune ber trees during first fortnight of April which results in early flowering and thus early harvest of fruits, though the maximum fruit yield was recorded when, the pruning was done in second fortnight of April (Ramadevi, 1989). In Maharashtra, the best time of pruning is before the end of April (Pareek and Vishal Nath, 1996; Deotale *et al.*, 1997).

Effects on vegetative growth

The time of pruning influences bud sprouting and determine annual vegetative growth of plant. Kundu *et al.* (1994), reported delayed bud sprouting due to delayed pruning with 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. Devi and Balon (1993), also reported advancement of bud sprouting with early pruning. The trees pruned on 14th April produced tallest plant and maximum number of branches per tree. Gupta and Godara (1989) however, reported that bud-sprouting percentage was not influenced by different time of pruning. The annual shoot growth as well as leaf area was found maximum on tree pruned in 30th May. The number of shoots and shoot length on trees pruned on 15th May were significantly higher as compared to 15th April while shoot length and diameter was at par on both the dates of pruning (Raut and Diware, 2005). Sandhu *et al.*, 1992, found that early pruning 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. The annual shoot growth and leaf area was found maximum on the trees prune on 30th May. Singh *et al.* (1978) pruned ber tree at 75 cm from base during last week of June and this resulted in better response in terms of shoot growth.

Effect on flowering, fruiting, yield and quality

The time of pruning in general has profound effect on bud sprouting, flower initiation,

fruit setting, yield and quality of fruits. In arid regions of north west Rajasthan, early pruning induces early flowering. The fruit yield is higher when pruning is done during the month of May. At Rahuri and Hissar, early pruning also advanced flowering (Anonymus, 1987a). Under Haryana conditions, maximum fruit retention was observed on trees when pruned to 15 buds per primary branch on 30th May (Kundu *et al.*, 1994). Devi and Babu (1993) observed early bud sprouting when trees were pruned on 14th April which resulted in production of tallest plant with maximum number of branches per tree. Gupta and Godara (1989), reported that bud-sprouting percentage was not affected by different time of pruning. Under Maharashtra state of India, early pruning (15 meteorological week) in cvs. Gola and Umran gave highest shoot diameter, shoot length and yield per tree (Deotale *et al.*, 1997). At Rahuri, Maharashtra, early pruning in April was effective in advancing yield per tree (Anon., 1987b). Pruning in first fortnight of April at Hyderabad, resulted in early fruit harvest because of enhancement in sprouting and flowering (Ramadevi, 1989). Yield and quality of fruits were best from trees pruned on 14th April and least from those pruned on 15th May. Under the rainfed conditions of Kandi, Punjab, pruning between 30th May and 14th June maintained tree vigour and gave the highest fruit yield (24.1-28.9 kg tree⁻¹) and quality of fruits (Aulakh, 1998).

Under the arid zone of Karnataka, India, pruning done on 15th April gave optimum performance in respect to 11 cultivars of ber (Umran, Kadak, Chhuhara, Dandan, Rhambor, Illaichi, Sanaur-6, Sanaur-2, Mehroon, Mundiya and Manuki). However, total soluble solids and pulp content of the fruits was highest when pruned on 30th April (Jawadagi *et al.*, 2001). Pruning of three-year-old *Ziziphus mauritiana* trees at fortnightly intervals from 15 April to 14 July revealed that pruning dates had non significant effect on vegetative growth but early-pruned trees flowered earlier by 14 days in the earliest pruned trees (Singh and Sandhu, 1984). Fruit set was highest (13.5%) in trees pruned on May 30th and lowest on July 14th (10.3%). The fruits matured on 18 and 28 March when pruned on April 15th and July 14th, respectively. Pruning during last week of June at 75 cm from base resulted better response

in terms of shoot growth (Singh *et al.*, 1978). Srinivas and Haribabu (1997) reported that time of pruning had significant influence on various parameters of flowering and fruiting. Early pruning (first fortnight of April under Hyderabad conditions) advanced the date of flowering with minimum number of days required to come to flowering coupled with earlier fruit maturity as compared to late pruned trees. Boora and Singh (2007), while working with time of pruning in ber also concluded that pruning in ber cv. Sanaur-2 should be done between 15-30th April by retaining 8 buds for higher yield of better quality fruits.

In hot arid areas of Rajasthan, usual pruning time is first fortnight of May which results in flowering during August-September and fruit maturity during December-February depending upon variety. In variety Gola, if pruning is done in middle of May, the fruits start maturing in the last week of December, which however, may continue upto the beginning of February. Increase in mean monthly temperature and decreased relative humidity during October-November in decade 2001-2010 as compared to previous decade (1991-2000) resulted in more flower and fruit drop and the resultant decrease in total fruit yield (Roy *et al.*, 2012). An experiment was therefore, conducted on re-scheduling of pruning in variety Gola at 10 days interval beginning from May to July to see its effect on fruit set, fruit drop and yield during 2011-12. It was observed that pruning at 10 days interval during the month of June or on 3rd July resulted in significantly higher fruit yield owing to decreased fruit drop as compared to pruning on 3rd, 13th or 23rd of May (Anon., 2011-12).

Pruning Severity

Effects of pruning severity on vegetative growth

As a general principle, it is observed that total growth attained by an unpruned tree is always more than that of a pruned tree regardless of the type or amount of pruning. This is because the growth incurred in response to pruning does not compensate for the portion removed by pruning plus the growth which would normally occur on that point (Rajput and Patnayak, 1985). The severity of the pruning is determined by the length of past season's shoot retained after pruning operation, i.e. 20-

25 cm (very severe), 40-60 cm (severe), 70-90 cm (moderate), 100-125 cm (light), 150 cm for very light treatment (Singh *et al.*, 1978; Gupta and Singh, 1979; Lal and Prasad, 1979). However the severity of pruning varies depending upon the vigour of the shoot (total length and diameter of the shoot). An alternative approach has been to base light, moderate and severe pruning on removal of one fourth, half and three fourth length of shoot, respectively (Sharma *et al.*, 1980; Singh and Godara, 1985; Yadav and Godara, 1987, 1992). The three severity levels have also been based on pruning the shoots at a point where it is 1, 2 or 3 cm in diameter (Bisla *et al.*, 1990). The pruning intensity of cultivar Umran was determined in relation to origin of new shoots and their productivity potential (Reddy, 1983). Pruning of main axis at 4-6 secondaries along with complete removal of secondaries gave higher yield at Jobner, Rahuri, Hisar and Bangalore conditions (Anon., 1987a). However, this pattern of pruning at Bangalore increased the spread of the trees resulting in overlapping and shading by 8th year. Further studies revealed that pruning half the number of shoots to 6th secondaries (15-25 nodes depending upon the cultivars) and remaining to previous season's growth retaining only the basal nodes gave better results (Anon., 1989; Kundu *et al.*, 1995). Results of multi location trials in India suggested that the main axis should be pruned at 15 to 25 nodes depending upon agro climatic conditions, i.e. at 20-25 nodes in arid areas and at 15 nodes in semi-arid or more moderate regions, along with complete removal of secondaries (Pareek and Vishal Nath, 1996).

The effects of 25% and 50% pruning intensity on the vegetative growth and yield of Indian jujube cvs. Baranasi Karaka, Gola, Ponda Safeda, Sua-Mundi, and Jogia) under semi-arid conditions revealed significant variation in growth of primary, secondary, and tertiary branches amongst the cultivars (Kumar, 2002). The maximum number of primary branches (4.45) was obtained with 25% pruning, while the highest number of secondary (6.70) and tertiary (6.12) branches were obtained with 50% pruning. The secondaries were found longest in 25% pruning, whereas, the tertiaries were longest in 50% pruning. The fruit yield (25.92 kg tree⁻¹) was highest for 50% pruning irrespective of cultivars.

Bajwa *et al.* (1987) analyzed the pruning severity treatment in ber cv. Umran by retaining 20, 40 and 60 cm basal portion of previous year's growth. They observed faster growth rate in pruned trees than unpruned ones with no significant effects on fruit set and fruit retention and finally concluded that pruning to 60 cm to be the best treatment. Kumar *et al.* (2002) studied the effect of light (20 cm), medium (40 cm) and severe (60 cm) pruning of secondaries from the top in three cvs. Gola, Umran and Banarasi Karaka and found that light pruned trees produced significantly higher fuel wood as compared to other two levels of pruning.

Khan and Hossain (1992) imposed severe, medium and no pruning (control) treatments to 15-year-old trees of *Ziziphus mauritiana* cv. Narikeli. The spread and height of the tree, leaf size, number of leaves/side shoot and number of new shoots/tree were greatest with no pruning while the length and diameter of shoots, the number of branches/shoot and the number of side shoots/branch were highest with severe pruning. Similarly, Gupta and Singh (1979) pruned ber trees by removing 25, 50 and 75% of the growth, and control (no pruning) and found that the numbers of new branches emerged were little affected by pruning treatment, but the average branch length and girth were greatest with the heaviest pruning.

Bajwa *et al.* (1986) reported faster shoot growth in pruned trees of ber cv. Sanaur-5 as compared to unpruned ones with highest weight of pruned wood per tree in severely pruned trees. Light pruned trees produced significantly higher leaf fodder and fuel wood (Kumar and Ram, 2009) as compared to severe pruning. Shoot length, leaf area and per cent bud sprouting differed significantly due to pruning severity in cv. Umran (Kundu *et al.*, 1994). Lal and Prasad (1979) and Dhaliwal and Sandhu (1984) reported that the growth in terms of number of shoots, shoot length and diameter was highest with moderate pruning.

Awasthi and Misra (1969) observed that unpruned ber trees produced the maximum number of shoots and put forth the maximum tree growth 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 increased significantly 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 secondaries gave higher shoot length in ber cv. Gola. Hiwale and Raturi (1993) also reported increased shoot length and diameter with increasing severity of pruning. However, number of new sprouts produced from the pruned branches decreased with increased severity. Nanthakumar 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 in commercial varieties (Banarasi and Umran). Pandey *et al.* (1998) observed no significant effect of pruning severity on length of primary, secondary and tertiary branches.

Raut and Diware (2005) imposed the pruning severity treatment based on shoot diameter i.e. removal of shoots at a point measuring 1 cm (light), 2 cm (moderate) and 3 cm (severe). It was revealed that shoot length and diameter were significantly higher when pruned severely or moderately, while number of shoots on pruned branches was significantly more in moderate pruning than on severe pruning and light pruning.

Recently, Kumar *et al.* (2014) imposed seven pruning treatments by heading back 10-60% portion of past season's growth along with unpruned control in ber var. Banarasi Karaka. The growth and yield parameters viz., days taken for sprouting, number of shoots emerged, number of retained shoots, shoot length, girth of shoots and fruit yield were markedly promoted by the 30% pruning intensity than rest of the treatments.

Effects of pruning severity on flowering, fruit set/fruit retention, fruit quality and yield

The pruning severity affects flowering time, fruit set, final fruit retention, fruit quality and yield of ber. Yadav and Godara (1992) found flowering, fruit set and fruit maturity delayed with increasing pruning severity and decreasing planting distance while per cent fruit set increased with increasing severity of

pruning and wider planting distance. They further observed higher fruit retention with increasing planting distance and decreasing severity of pruning. Moderate pruning induced maximum flowering (Lal and Prasad, 1980a), fruit set and fruit retention (Dhaliwal and Sandhu, 1984; Gupta *et al.*, 1990; Yadav and Godara, 1992). The severe pruning decreased the number of flowers per cyme (Dhaliwal and Sandhu, 1984; Nanthakumar, 1991), while fruit set increased with increasing pruning severity and fruit retention increased with decreasing severity (Yadav and Godara, 1992; Syamal and Rajput, 1989). Bajwa *et al.* (1986) recorded increased fruit set and retention by light pruning in ber cv. Sanaur-5 while severe pruning produced heavier fruits but fruit yield was maximum in unpruned trees. The response of pruning in ber may also be cultivar specific. Bajwa *et al.* (1987) reported that fruit set, fruit retention and pulp content did not differ significantly due to pruning treatments in cv. Umran. Light pruning reduced fruit drop (Lal and Prasad, 1980b) and enhanced fruit weight and size with increasing pruning severity but fruit yield declined as a result of increasing pruning severity (Bajwa *et al.*, 1987). Mean fruit weight and size were enhanced by pruning treatments but fruit yield and quality did not differ significantly when compared to control (Gupta and Singh, 1979). Sharma *et al.* (1980) obtained highest fruit yield with light pruning (25%) but the tree vigour was best under 50% pruning. Light pruning (heading back all scaffold branches to 120 cm) resulted in maximum fruit weight, volume and pulp stone ratio whereas, severe pruning (60 cm) or very light pruning had negative influence on these indices (Lal and Prasad, 1981). Nanthakumar and Shanmugavelu (1993) also recorded highest mean fruit set (10.38%) and yield (21.51 kg tree⁻¹) with medium pruning compared to severe and light pruning.

Khan and Hossain (1992) recorded significantly more fruits/tree using severe pruning (2971) than with medium pruning (2848) or no pruning (1980). The fruit TSS content followed a similar pattern, being 18.3, 17.7 and 16.5% for severe, medium and no pruning, respectively.

Experiment involving combination of pruning time and intensity revealed that maximum value in respect of number of flowers, fruit set and

yield of five cultivars of ber were associated with severe pruning on 25th March under Maharashtra conditions (Bharad and Tyade, 1998). Similar trials carried out by Gill and Bal (2006), however, they reported increased fruit set and retention with decrease in the pruning severity and significantly higher values in the unpruned trees and lower in trees pruned by retaining 2 buds under Punjab conditions. The fruit set and retention increased with the delay in pruning up to 9th and 23rd May, respectively. Maximum fruit size and weight were recorded in trees pruned between 9 and 23 May by retaining 6 buds while fruit yield increased significantly with the decrease in pruning severity. Pandey *et al.* (1998) recorded maximum number of the flower/cluster on primary, secondary and tertiary branches under 50% pruning intensity. Medium pruning gave the highest number of flowers per branchlet, percentage of bisexual flowers and yield per tree in Banarasi, Umran, and *Z. rotundifolia* (Nanthakumar and Balakrishnan, 1999). Singh *et al.* (1978) reported that increasing pruning severity from 25 to 75% increased the pulp/stone ratio, total soluble solids (TSS) and vitamin C content but decreased titratable acidity. Bajwa *et al.* (1987) also recorded increased TSS and decreased acidity and ascorbic acid with increasing pruning intensity. However, Kumar *et al.* (2002) recorded significantly higher vitamin C content in light pruning compared to medium pruning. Significantly higher reducing sugars and non-reducing sugars have been reported by several workers with pruning at 25 cm and 125 cm (Bajwa *et al.*, 1988; Syamal and Rajput, 1989). Likewise, 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°Brix) in the trees pruned at 120 cm of previous season growth whereas maximum fruit weight and yield was recorded in pruning at 90 cm. 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 allowing more light and less competition for the growth of individual fruit compared to unpruned tree under semi arid dry condition in North West part of the India. Awasthi and Misra (1969) reported that initial fruit set was higher on heavily pruned plants at 25 cm but the final retention was higher in light pruning at 75 cm with larger fruit size.

Gupta and Singh (1979) reported that there were significant differences in average weight and size of the fruits under different pruning treatment.

There are differences of opinion amongst different researchers with respect to effect of pruning on fruit yield of ber. However, the majority of the findings revolves around the fact that pruning reduces the total yield but it increases the yield of good quality fruits. The fruit yield of ber decreases with increase in pruning severity and it was highest in unpruned trees or light pruned trees irrespective of grade or quality (Dhaliwal and Sandhu, 1984; Bajwa *et al.*, 1986; 1987; Syamal and Rajput, 1989; Kundu *et al.*, 1995). Gill and Bal (2006) found that fruit yield increased significantly with decrease in pruning intensity. Similar results were also reported by Dhaliwal and Sandhu (1984) who obtained highest fruit yield in control and light pruning. In another study, fruit yield decreased with pruning and increasing pruning intensity further reduced it (Bajwa *et al.*, 1987). Contrary to these findings, Kumar (2002) while studying the effect of light, medium and severe pruning on ber cvs. Gola, Umran and Banarasi Karaka found significantly lower fruit yield in severely pruned trees compared to light and medium pruning treatments. This finding also supported the earlier results obtained by Khan and Hossain (1992) who also found that yields of ber trees with severe (59.3 kg tree⁻¹) and medium (55.7 kg tree⁻¹) pruning were significantly higher than with no pruning (36.9 kg tree⁻¹). Recent report by Kumar *et al.* (2014) also strengthens the theory of moderate or light pruning (30% removal of top growth) in var. Banarasi Karaka yielding maximum (109.19 kg plant⁻¹) which was significantly higher over 10% pruning and control.

Certain pre and post-pruning sprays have been tried to induce early bud burst and to improve the production of more number of vigorous shoots. Kurian (1985) was able to induce early bud break and increase the number of vigorous sprouts by pre-pruning sprays of 3% thiourea along with two post pruning sprays of 100 ppm benzyladenine or 50 ppm TIBA at monthly intervals. A pre-pruning spray (48 hours before) with 3% thiourea followed by pruning half the shoots at 25 nodes and remaining half to the previous season's growth gave the highest fruit yield of 128 kg tree⁻¹.

Conclusions

On the basis of literature reviewed on the effect of pruning, its time and intensity, it is clearly evident that pruning is an essential operation in Indian jujube to get higher yield of quality fruits. In the beginning, pruning is done to develop proper tree architecture capable of bearing heavy load of fruits without impairing fruit quality. In the later years, it has to be essentially practiced every year at a particular time depending upon the geographical area. Pruning in ber has two aspects i.e., pruning time and severity. While pruning time has an important bearing on onset of flowering, it also decides the fruit set, final fruit retention and fruit maturity time. Pruning intensity or severity also affect flowering, fruiting, physical and chemical fruit quality parameters and ultimately the yield. The work carried out especially on pruning severity, it appears that it is based mostly on the length or percentage of previous year's growth of branches that are retained by pruning. Mostly retaining 20, 40, and 60 cm shoot length has been considered as severe, moderate and light pruning respectively. In terms of percentage of past years growth, 25%, 50% and 75% retention of past year's growth has been taken as severe, medium and light intensity pruning levels, respectively. The pruning intensity has also been decided based on the number of basal buds retained on previous year's growth. In some cases, the intensity has also been decided based on shoot diameter i.e. shoots measuring up to 1 cm, 2 cm, and 3 cm for light, medium and severe pruning, respectively. It is noticed that length of shoot retained for the purpose of deciding the light, medium and severe pruning has not been followed uniformly by different researchers. Thus, there is need to standardize uniform practice in this regard. The severity of pruning may also vary depending upon whether the orchard is irrigated or rainfed. There seems to be unanimity amongst different workers that moderate pruning is ideal for getting the higher yield of good quality fruits whether it is based on length of shoots or number of basal buds. In some cases, especially for rainfed conditions, light pruning should also be encouraged.

Way Forward

Further studies on pruning of ber must be based on uniform criteria especially with

regards to pruning intensity. In the work done so far different assumption such as percentage of past season's growth to be retained by pruning based on shoot thickness or number of basal buds. In the future works, number of basal buds to be retained per primary from the main axis should be fixed uniformly irrespective of shoot diameter. More over, variety specific pruning should also be standardized, since the growth habit of different varieties may vary. The varieties may also be grouped according to growth habit in reference to pruning intensity. Since, it is possible to regulate the onset of flowering, fruiting and fruit maturity by pruning and other cultural manipulations, work may also be initiated on rescheduling pruning as a means of getting higher fruit set/reduced fruit drop due to shift in flowering and fruit setting time either before or after post monsoon rise in temperature and decline in atmospheric humidity. Some studies on this line at CAZRI Jodhpur has given positive results. As far as pruning in different ber growing region is concerned, the present guidelines of pruning according to geographical location and rainfall pattern should continue with a possibility of slight adjustment to regulate fruit maturity at desired time.

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